Currie, Coopers & Lybrand

Management Consultants

ROYAL COMMISSION ON THE OCEAN RANGER MARINE DISASTER

ASSESSMENT OF THE NORMAL AND EMERGENCY COMMAND STRUCTURES RELATING TO DRILLING SYSTEMS FOR EASTERN CANADA OFFSHORE DRILLING OPERATIONS

May 25, 1984

CAUTIONARY NOTE

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May 25, 1984

Submitted to: Mr. R.G. Dyck, Studies Manager

Submitted by: Mr. D.E. Smith
Mr. K. Jolliffe

ROYAL COMMISSION ON THE OCEAN RANGER MARINE DISASTER

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APPENDICES

EXECUTIVE SUMMARY

This section outlines the main elements of the full report. While we have attempted to include all of the essential points from the full report, full supportive evidence and elaboration will need to draw from the main body of the report.

I. PURPOSE OF THE STUDY

The main purpose of the study was:

- to identify and document the different types of command structures used in drilling systems off Canada's east coast:

- to evaluate the effectiveness of these structures for dealing with emergency incidents including a major fire on board, the loss of helicopter, the loss of support vessel, the loss of well control, and the loss of rig stability.

- to draw conclusions about the existing and possible alternative command structures.

II. DESCRIPTION OF COMMAND STRUCTURES FOR THE EAST COAST CANADIAN OFFSHORE DRILLING OPERATIONS

Since personnel safety was the focal point in our evaluation, the command structures which we reviewed embraced not only specific operator and drilling organizations, but also the links with helicopter and supply boat companies, C.O.G.L.A., N.L.P.D., the C.C.G. and S.&R. Thus, our intent was to evaluate the effectiveness of the onrig/shore-based relationship and their interactive effectiveness with these other support organizations under both normal, and emergency conditions.

SUMMARY OF COMMAND STRUCTURES BY RIG TYPE

COMMAND STRUCTURE / RIG TYPE	SENIOR PERSON IN CHARGE				
	DRILLING:	DRILLING ONLY WHILE STATIONERY ON HOLE	MARINE: (RIG MOVER) ONLY WHILE UNDERWAY	MARINE ONLY WHILE NOT DRILLING OR IN EMERGENCIES	MARINE AT ALL TIMES
JACKUPS	X		X		
DRILLSHIPS: D.P.					X
Anchored	X		X	X	
SEMI-SUBMERSIBLE "Norweigan"					X
"Norweigan Variation"		X	X	X	
"American" (Under U.S. Flag	X				

NOTE: There are some variations even within these categories. e.g. a D.P. Drill Ship may be under command of the senior drilling person, to all intents and purposes, while the ship is on the hole and drilling. Similarly, the "American" model varies to the extent that in Canada, U.S. flag vessels have captains on board but their real roles vary from virtual token responsibilities through to replicating the "Norweigan variation.

A. GEOGRAPHIC LOCATIONS HAVE A BEARING ON COMMAND STRUCTURES

Geographic location, dictates in part, the type of total system command structure. Remote locations such as the Davis Straits require virtual self-sufficiency by the operations for normal and emergency situations. In multi-operator areas, Operators have access to assistance from other operators and government search and rescue assistance. In order to achieve maximum benefits in multi operator areas from the other elements present, clearly defined policies and procedures are required. These have recently been enhanced in the form of a Joint Operator Alert Plan.

B. COMMON COMMAND STRUCTURES

We have identified a series of generic command structure models for each of the basic drill rig types. These are summarized in the chart on the facing page.

1. <u>Jackup</u>

- secured to the seabed by structural legs which support the platform

- in the drilling mode, it is commanded by a senior toolpusher (or rig superintendent).

- a barge master, usually with some marine experience and often responsible for safety, logistics and life boat operations, reports to the senior toolpusher.

- when under tow or in a non-drilling mode and location, command is formally handed over to a certified rig mover who has, as part of his certification, marine qualifications. While

undertow a licenced insurance representative monitors the move.

2. Drill Ships

- required by the Canada Shipping Act to have a Master Mariner with an unlimited foreign going certification in command.

- the command structures vary to some degree depending on whether the ship is anchored or dynamically positioned (D.P.) while drilling. The usual cases are:

  - dynamically positioned; the captain is in full command at all times;

  - anchored; the captain may or may not be in full command at all times. Often, the senior drilling person is in command while drilling. The captain assumes overall command when moving and in emergency situations.

3. Semi-Submersible

Semi-submersibles may be self-propelled and dynamically positioned or anchored, or they may not be fully self-propelled. The Canada Shipping Act classifies self-propelled semi-submersible as vessels and requires a marine captain with an unlimitd ticket on board. However, the Act does not clearly specify the role and extent of responsibilities of a captain under all conditions on a semi-submersible.

The following are the categories of command structures for semi-submersibles. They are summarized in the chart on the facing page.

a) Norweigan Model

Norway's regulations are clear and stringent. A marine captain must be in overall command of the rig at all times. In the event of a serious accident this, according to their law, permits them to single out the one person who has ultimate responsibility. There are examples of drilling contractors who ascribe to this model in Canadian waters. The drilling and marine persons may report to senior and separate drilling and marine persons on shore.

b) "Norweigan Variation"

The basic variation to the pure Norweigan structure is:

- Captain in command while underway and in emergency situations

- Captain responsible for safety of the personnel and the rig, and often supevises all non-drilling activities.

- senior drilling person in charge while driling but command is assumed by the captain as noted above.

- both usually report to a shore based operations superintendent. In some cases, they may report separately to marine and drilling managers on shore.

c. "American Model"

American rigs which operate under the U.S. flag (and especially when operating in U.S. waters) have a

straightforward command structure. It is probably based on a land-based drilling tradition but has been modified to U.S. Coast Guard requirements as follows:

- Senior drilling person is in command at all times;

- this person is required, in the U.S., to hold a limited marine ticket and a Column Stabilized Masters Ticket. These certifications provide specific marine and semi-submersible trianing. The tickets are not recognized in Canada nor can a non U.S. citizen obtain them.

- U.S. semi-submersibles which operate in Canada do have a master mariner (captain on board)

- in some cases, the captain has very little responsibility, and in practice the senior drilling person really is in command at all times, and

- some U.S. rigs have adopted the "Norweigan variation" noted above.

III. EXAMINATION OF INCIDENTS

We were asked to examine examples of two incidents for each of the five categories noted previously. Preferably these incidents should be drawn from Canadian East Coast operations.

Considerable difficulty was encountered in obtaining reliable and detailed incident reports. Additionally, only one incident from Canadian operations was found with respect to a blow-out situation, helicopter crash, and supply boat sinking. In these cases additional incident documentation was sought from United States operations, and, where these were obtained, an analysis was carried out.

The incident reprts underlined the importance of human error as a contributing cause to personal injuries and loss of life experienced. The reports further documented the need for a clear chain of command, for leadership abilities to provide firm direction during emergency situations, for well developed emergency or contingency plans, and for emergency drills to ensure that all crew members understand the actions required in emergency situations.

VI. EVALUATION OF COMMAND STRUCTURE EFFECTIVENESS

A summary of our evaluation of command structure effectiveness is provided in this section of the report. Command structure effectiveness was evaluated against eight criteria. The main report provides a discussion of each of the criteria.

A. COMPETENT AND TRAINED PEOPLE ARE REQUIRED

The first criterion for command structure effectiveness is the presence of a fully trained crew and staff complement.

1. Trained Marine Skills Are in Short Supply

- Training programs to develop marine skills for drilling personnel are not well developed in Canada.

- Interviews indicate that trained and experienced deck officers with drilling experience are in short supply world wide.

- Typical Canadian marine training for conventional vessels is not comprehensive enough to apply to twin hulled semi-submersibles or even drill ships, particularly in the areas of ballasting and the inter-relationship with drilling operations.

- C.O.G.L.A. and provincial Canadian content guidelines and regulations are a dissausive factor for foreign crew to come to Canada, and

- The industry is consequently forced to spend more on training and place less experienced people than desired in senior positions.

2. Back-Ups for Key Resources are also in Short Supply

- The gap in experience and training between Captains and other deck officers and ballast control operators is pronounced.

3. Recognized Training Qualifications and Certifications do not Exist for Several Positions

- No certification program for rig deck officers exists in Canada.

- The U.S. has a Columnized Masters Certification Ticket but this is available only to U.S. citizens in the United States.

- Although the drilling Contractors have a planned program assembled, no standard ballast control training and certification program is in place. This is also true for rig movers and barge masters.

- Two schools in St. John's and Halifax provide government and industry acceptable survival training. All rig crews are being processed through these systems.

- Planning for a standardized life boat captain training program is underway.

4. Government Regulations/Guidelines Do not Fully Recognize the Specific Requirements of the Industry

- The Canada Shipping Act requires a captain on board self-propelled rigs which are deemed to be vessels. The Act does not spell out specific training required or recognize the full differences between conventional vessels and rigs.

- C.O.G.L.A. guidelines indicate that a rig should be commanded by a person who has experience in drilling but specific qualifications are not spelled out.

B. A STRONG UNIFIED STRUCTURE MUST EXIST

1. The Degree of Unity of Command is Partially a Function of the Type of Rig

a) Jack-ups are commanded totally by a drilling person when drilling and by a rig mover when off the hole or in port. The command structure is clear and unambiguous.

b) Drill Ships have a clear structure in most cases, with a marine captain in command at all times. In some cases, there is a duality or sharing of command between the Captain and drilling superintendent. In the latter case, response plans do not clearly state alert conditions which trigger overall command by the Captain.

c) Semi-submersibles have a variety of command structures. When there is a shared command situation the response plans do not usually specify clearly conditions or stages when total command is assumed by the Captain.

The shared command systems could lead to potential confusion in absence of clear conditions specifying command and of an understanding of this by the crew. The North Atlantic dictates the need for sound marine experience and skills. The marine skills and managerial attitudes must blend with those of the drilling operation.

2. Knowledge and Mutual Respect are Key Contributors to Unity of Command

Mutual respect between drilling and marine elements and the welding of these different skills into a united team, can only be achieved by having these individuals work together over a period of time so that an appreciation of each other's skills is obtained. This will foster effective command on board.

3. Divided or Shared Command Can Weaken Response Effectiveness

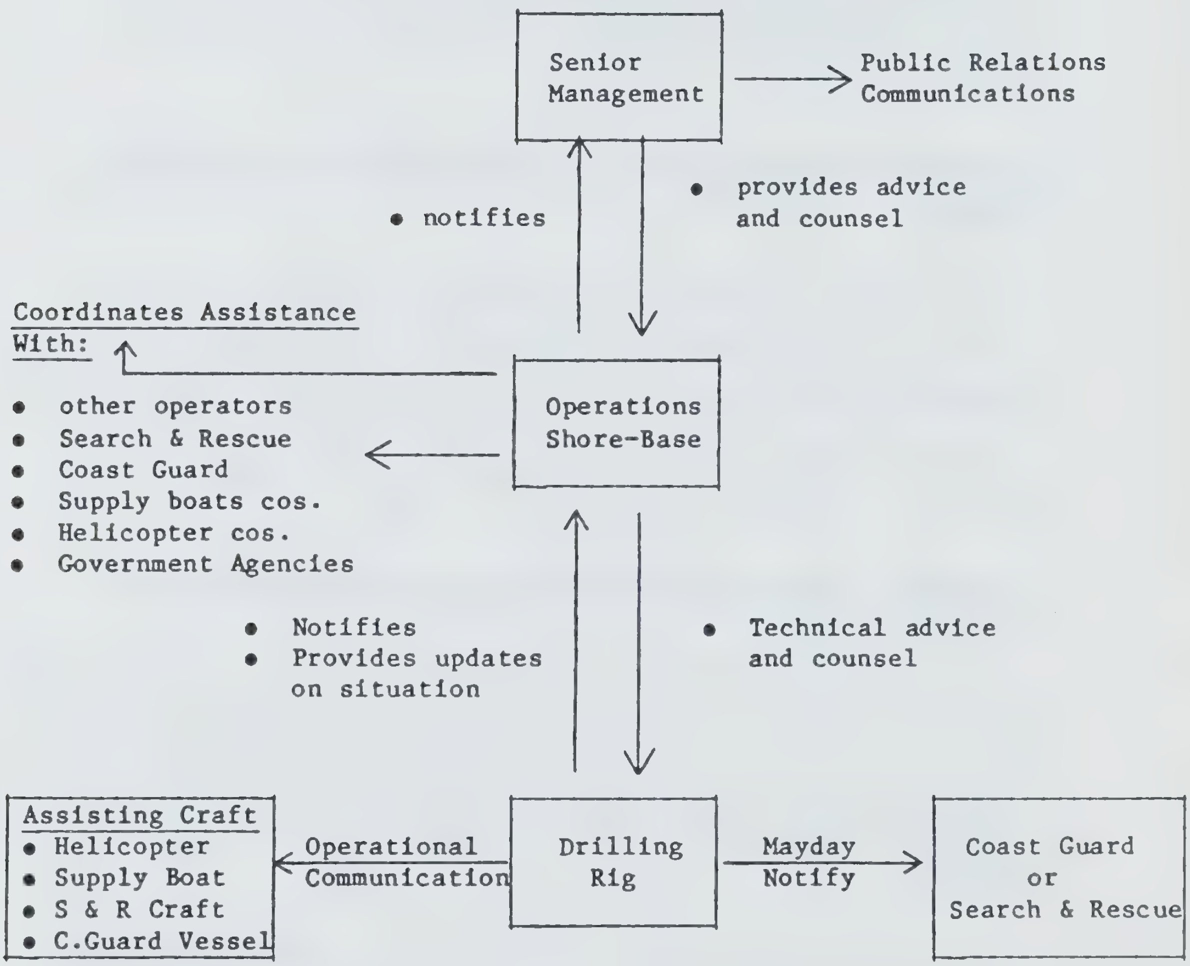
It is our observation that if a marine captain is unfamiliar with drilling, and/or is a weak manager, the senior drilling person will be (and seem to be by the crew) de facto commander in all situations. This could lead to conflict detrimental to crew safety.

The converse is also true. It must also be recognized, however, that Canadian environmental conditions require dedicated attention to both the drilling and marine elements. Therefore shared command structures shuld be clearly designed and unequivocal.

4. Command Structure Documentation Could be Improved

To fully support cases and where command transfers from the drilling to the marine element in emergency conditions, response

MODEL OF EMERGENCY COMMUNICATION PROCESS



plans and procedures should clearly outline the trigger points. A few plans were weak in this area, particularly:

- in not clearly citing back-ups to senior personnel;
- confused reporting lines;
- charts which state captain's responsibilities that are greater than in practical, operating fact.

C. COMMAND STRUCTURES SHOULD MOVE TO SUCCESSIVE ALERT STAGES

The majority of response plans indicate alert stages. However, some weaknesses are apparent:

- alert stages in shore based offices are not clear,
- heavy weather conditions for an on-board alert not stated,
- conditions to put Search and Rescue on active alert not indicated.

D. A STRONG SENSE OF ORGANIZATIONAL UNITY - TEAMWORK ENHANCES EFFECTIVENESS

Organizational effectiveness cannot be legislated. It takes time for organizational cohesiveness to be built up. Rapid moves to "Canadianize" the industry could have a negative effect on organizational unity.

E. EFFECTIVE COMMUNCIATIONS PROCESSES ARE REQUIRED

The model on the facing page outlines a simple communications process. Our observations of common aspects of response plans were as follows:

- overly complex communciations patterns for the rig commander.

- base operations to communicate directly with on-scene helicopters and supply boats instead of operational communications direct from the Rig commander.
- long lines of communication up the organization's hierarchy;
- communications from rig not clearly centralized through the base emergency command centre.

Generally, documented communications patterns attempted to cover all eventualities and to adhere to various government guidelines without adhering to the principles of short communication lines to deal with emergencies.

F. EFFECTIVE PROCEDURES TO COORDINATE THE EFFORTS OF ALL ELEMENTS IN MULTI-OPERATOR AREAS

A mutual aid pact amongst operators has been informally in place for some time. The related policies, procedures, and systems have recently been further developed and documented. The plan serves to significantly enhance rescue operations. In addition, flight following, iceberg and weather tracking systems are in place. We believe that more work, however, is necessary to ensure C.C.G. and S&R are fully conversant with the plan.

G. EXERCISE OF THE COMMAND STRUCTURE IS REQUIRED

A variety of contractor specific on-board drills and multi-operator government agency drills have been conducted. On board drills have generally ensured that rig personnel are familiar with their duties in emergency situations. Further enhancements would however be useful including:

- suprise drills to simulate actual conditions.

- designated individuals should act as observers to provide feedback on drill effectiveness. Formal debriefing sessions to evaluate effectiveness should also be instituted.
- equipment and evacuation systems should be enhanced so that full evacuation drills can be safely carried out.
- drills should be designed to test the preparedness of back-up personnel.
- further exercises should be conducted on a regular basis to ensure adequate familarity by Search and Rescue and the Coast Guard with drilling operations.

H. DECISION MAKING MUST BE CLOSE TO THE SCENE OF THE ACTION

Some response plans imply that key decisions are to be made by shore based managers. However, all officials in the industry whom we interviewed agreed that decisions regarding rig operations, rescue, evacuation or assistance needs should be made at the scene.

V. RECOMMENDATIONS FOR IMPROVED COMMAND STRUCTURE EFFECTIVENESS

A. THE SUPPLY OF, AND METHODS FOR TRAINING, QUALIFIED PEOPLE SHOULD BE ENHANCED

The following actions should be implemented:

1. Evaluate Canadian marine training and develop improvements to address offshore drilling needs.

2. Recognize offshore drilling as a subset or specialty section of Canadian marine training and adopt appropriate guidelines/regulations.

3. Implement standardized ballast control training.

4. Continue marine survival training;

5. Develop appropriate standards for offshore drilling in cooperation with the C.C.G.

B. EXISTING REGULATIONS SHOULD BE MADE INDUSTRY SPECIFIC

Update standards and qualifications to address the industry requirements.

C. DEVELOP STANDARDS FOR UNITY OF COMMAND

Some command structues indicate a unity of command, at least in theory, e.g. on jack-ups and some drill ships and semi-submersibles. Others show a shared responsibility with the captain assuming responsibility in emergencies.

On drill ships and semis, there is a clear need for both marine and drilling expertise in Canada's waters. The development of an adequate supply of fully qualified rig commanders who have skills in both the marine and drilling functions will take several years to achieve. Therefore, the propensity to continue with shared responsibilities in some organizations will likely continue to exist. Certain conditions would need to be met as follows:

- assign real, not paper, responsibilities to marine captains including supervision of all safety features and certain on-rig support services such as general rig maintenance, etc.

- assign supreme command to the Captain in emergency situations and when underway;

- define clear guidelines which say when command should be under the Captain.

- ensure emergency response plans indicate emergency alert conditions which trigger the captain's assumption of command, and

- ensure organization charts developed and adopted by the industry are straightforward and not confused with combinations of duplicate solid or dotted line relationships.

D. COMMAND STRUCTURE ALERT STAGE DOCUMENTATION SHULD BE FURTHER DEVELOPED

1. Operator/Contractor emergency response plans should describe conditions of successive alert for shore based operation.

2. Plans should indicate conditions under which the rig should call S&R and/or C.C.G..

3. An understanding by all elements, including S&R and C.C.G. of the pertinent aspects of the response plans should be confirmed.

4. Industry-wide alert stages for each of the five emergencies addressed in this study should be adopted in the response plans.

E. DRILLING UNIT TEAMWORK AND COHESIVENESS SHOULD BE ENHANCED

The following should be provided to supervisory personnel across the industry:

- leadership and interpersonal skills training.

- training programs which foster understanding of the technicalities and attitudes and value systems in marine and drilling staff of each other's backgrounds.

In addition, Canadianization programs should move slowly so not to jeopardize teamwork and safety. We suggest that a high ratio of fully

to newly trained staff be maintained at non "officer" levels at all times.

F. COMMUNICATIONS PROCESSES SHOULD BE STANDARDIZED

A basic communication pattern for emergencies should be:

- rig commander (or delegate) notifies S&R, C.C.G., and operator shore base of an alert or actual emergency,

- rig commander talks directly with helicopter and supply boat captains,

- <u>all</u> communications are centralized in Operator's emergency command centre,

- adopt an industry wide standard set of alert codes and ensure that the appropriate responses are understood by all elements.

G. EXERCISE OF THE WIDER COMMAND STRUCTURE SHOULD BE MORE FREQUENTLY UNDERTAKEN

The following should be adopted across the industry:

- drills to test knowledge and effectiveness of back-up positions

- ensure all elements, through multi-operator "paper" exercises test and confirm each organization's knowledge of their roles, communication systems, responses and logistical requirements;

- involve C.C.G. and S&R in exercises once per year for each rig in order to test their systems and enhance their knowledge of drilling operations.

- joint exercises involving new rigs in the drilling area should be conducted as soon as possible.

Much progress has already been realized in recognizing the importance of command structure effectiveness to the offshore drilling industry. Many improvements have already been implemented. **We view the staffing and training of qualified resources and the adoption of recognized certification programs as the most critical element in improving command structure effectiveness.**

I. INTRODUCTION

In September of 1983 Currie, Coopers & Lybrand was retained by the Royal Commission on the Ocean Ranger Marine Disaster to prepare an assessment of the normal and emergency command structures and their functioning in relation to drilling systems for Eastern Canada offshore drilling operations. The objectives for the study include the following:

- To compile a list of all drilling systems which have been used in the study area from 1975 to the present;

- To document the normal command structure for "drilling systems" in Canadian offshore drilling operations.

  The "drilling system" includes the oil company, drilling contractor, marine support, air support, and sub-contractor personnel.

- To group the various command structures into a small number of like normal command structures which show the basic normal command structure for the "drilling system" in its entirety.

- To identify all incidents in eastern Canada offshore where the normal command structure has been converted to an emergency command structure. This will include all actual or apprehended circumstances involving a major fire on a drilling unit, the loss of a support vessel, the loss of a helicopter, the loss or disablement of the drilling unit, or the loss of well control.

- To analyze a minimum of two examples of each type of the previously named incidents. If possible, these incidents will be from the eastern Canada offshore.

- To develop criteria for effective emergency command structures for each type of incident.

- To evaluate planned emergency command structures for each type of incident which have been formulated for eastern Canada offshore drilling

programs against the developed criteria and to assess their effectiveness.

A more complete statement of work for the project is contained in Appendix I.

The report presents the methodology used to carry out the study, describes the common command structure types found for different types of drilling units (e.g. drill ship, semi-submersible, and jack-up), presents findings from our examination of the five different types of incidents, discusses the criteria which have been developed for measuring command structure effectiveness, and finally presents our evaluation, findings, and conclusions with respect to command structures and their effectiveness.

II. METHODOLOGY

Our initial task in carrying out the project was to develop a tentative interview guideline/questionnaire to be used in our interview program, and to identify knowledgeable oil industry, drilling contractor and sub-contractor personnel to be included in the interview program. The interview questionnaire was designed to develop information on:

- the different types of command structures used by the drilling industry in the period 1975 to the present.

  - how these structures change depending on whether the rig is in port, under tow, positioning, positioned but not drilling, or drilling.

  - the pros and cons of each of these different organization structures in normal and emergency conditions.

- The interfaces in the command structure of the rig itself with other support operations such as the Coast Guard, DND Search & Rescue, helicopter service, supply boat operators/captain, and shore-based Contractor's/Operator's structure.

- The communication patterns and procedures which are followed in normal operating conditions and those which are implemented to deal with each of the five types of emergencies.

- The extent to which government regulations, as they now exist, help with respect to the establishment of effective command structures, and how these might be modified.

- The extent to which safety training and drills exercise the command structure and provide satisfactory data on command structure effectiveness.

In addition Operators, Contractors and others were asked to provide documentation with respect to the command structures for their drilling units. Such documentation included a description of Contractor/Operator responsibilities vs. others in the command structure, job descriptions of key personnel, and emergency response plans to deal with each of the five emergency types. The respondents were also asked to cite all potential, apprehended, or actual emergencies which they had knowledge of.

The interview questionnaire was tested during the first few interviews, modified as a result of comments received from the initial interviewees, and submitted to the Royal Commission in our report dated December 2, 1983. It is attached to this report as Appendix II. In our report to the Royal Commission on December 2, 1983 we also provided a list of the individuals we planned to interview. A copy of the list of those individuals we actually interviewed is included as Appendix III to this report.

Following these interviews, the interview data and emergency reponse plan documentation was reviewed. Command structures were then grouped into common types for each type of drilling unit - drill ship, semi-submersible, and jack-up - and were then documented.

Based on our knowledge of sound organizational principles and contingency planning, we then drafted the preliminary criteria which we would use in evaluating the effectiveness of drilling command structures. The appropriateness of these criteria were tested by carrying out further interviews with a small number of knowledgeable individuals from contractor and oil company organizations. These criteria were tested further by the examination of actual incidents of the five types specified in the terms of reference for the study.

The common command structures used in east coast Canadian waters were then evaluated against each of these criteria. Our preliminary observations, findings and conclusions concerning their effectiveness were further tested and evaluated by carrying out interviews with a sample of industry personnel. The findings and conclusions were then refined and modified as appropriate.

The next section of the report describes the common command structures which we identified.

III. DESCRIPTION OF COMMAND STRUCTURES FOR EAST COAST CANADIAN OFFSHORE DRILLING UNITS

The terms of reference for this study requires the examination of command structures for "drilling systems" operating off the east coast of Canada during the period 1975 to 1983. A list of such units is included as Appendix IV. Representative documentation describing the command structures in this list was obtained from Operators, Contractors, and the Royal Commission.

We provide in this section of the report an overview of the principal types of command structures found and comment on the differences between them. The principal types of command structures differ depending on the type of rig, its flag, and the particular Operator and Contractor. We

first describe the organizational arrangements normally found in Canadian east coast drilling which are common to almost all command structures.

A. COMMON COMMAND STRUCTURE ARRANGEMENTS FOUND IN CANADA

In Canada, the oil company (Operator) generally acts as the focal point or hub of the command structure. Common arrangements in Canada include the following:

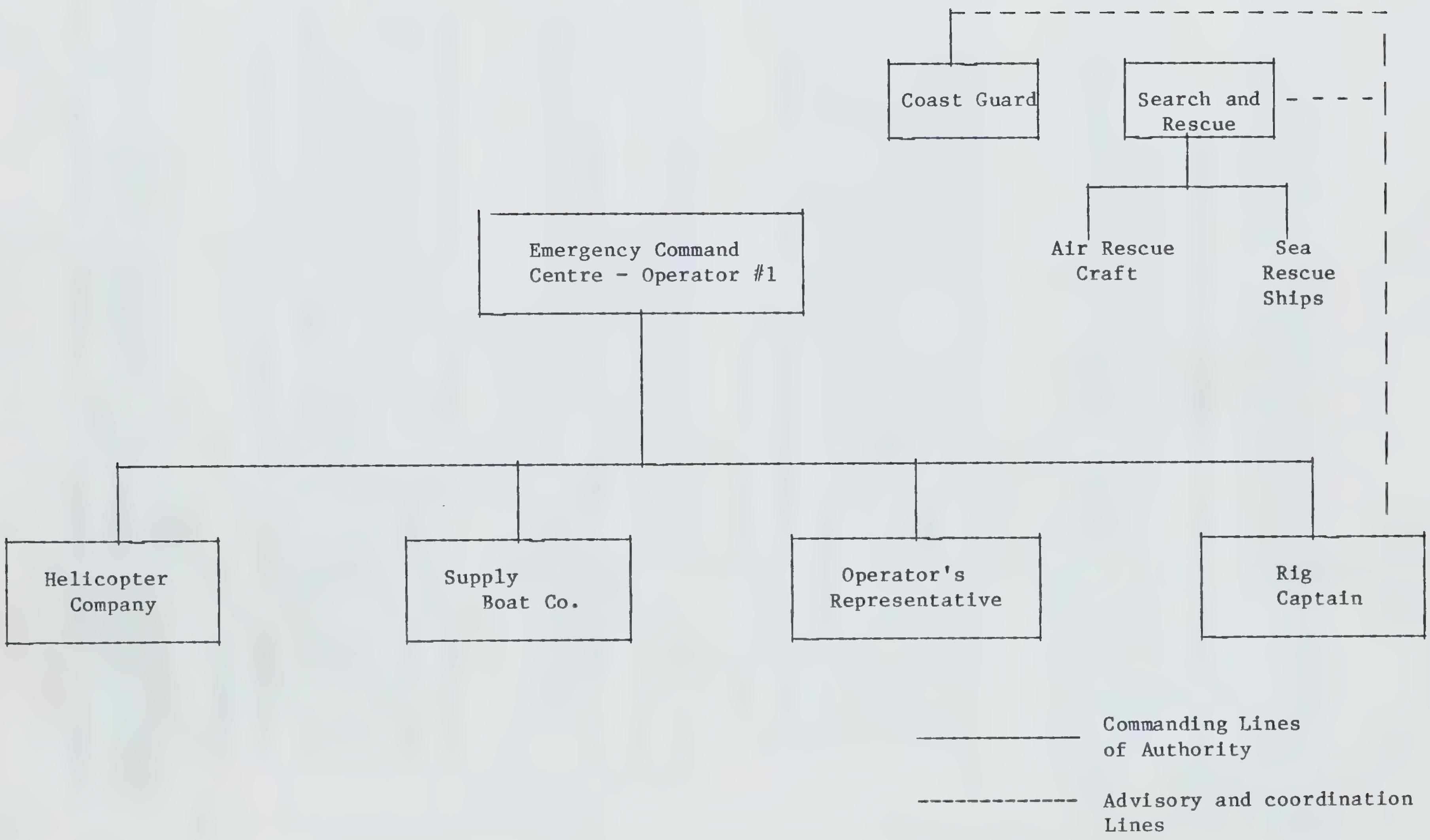
- It is usual for the Operator to contract for the drilling rig, for helicopter and supply boat support, and to provide a shore-based support structure for materials, supplies, and administrative and technical support. Additionally, the Contractor has a major support group for the total rig operation. It is normal for all elements, to take general direction from the oil company since they are under contract to the Operator.

- The Operator also is the only party to have knowledge of the geology of the structures into which the rig is drilling and therefore takes direct responsibility for defining the drilling program. It is therefore in the best position to evaluate appropriate actions to respond to potential and actual losses of well control.

- In Canada, the role of the Operator is further strengthened by the fact that government, through the Canadian Oil and Gas Lands Administration (C.O.G.L.A.), deals principally through the Operator in granting permission to drill, developing and submitting emergency reponse plans, and ensuring that plans are effectively implemented, and all government safety rules and regulations adhered to.

Also, the shore-based operations support centre, which all operators maintain, is in the best position to assist the senior offshore rig manager in times of emergency. It coordinates activities with other

SINGLE-OPERATOR ORGANIZATIONAL MODEL



operators, helicopter companies, supply boats, and governmental agencies. This is so because the Operator's support base has the necessary communications equipment and has the time to carry out this role better than the rig which could be encumbered by the immediacy of the emergency. Also the Operator is best suited to this role as it has established cooperative relationships with other operators in the area. The amount of authority and responsibility delegated by Operators to their offshore rig commanders can vary from company to company. A description of the normal and emergency responsibilities for those elements of the drilling system whose responsibilities do not change substantially with the type of rig is provided in Appendix V.

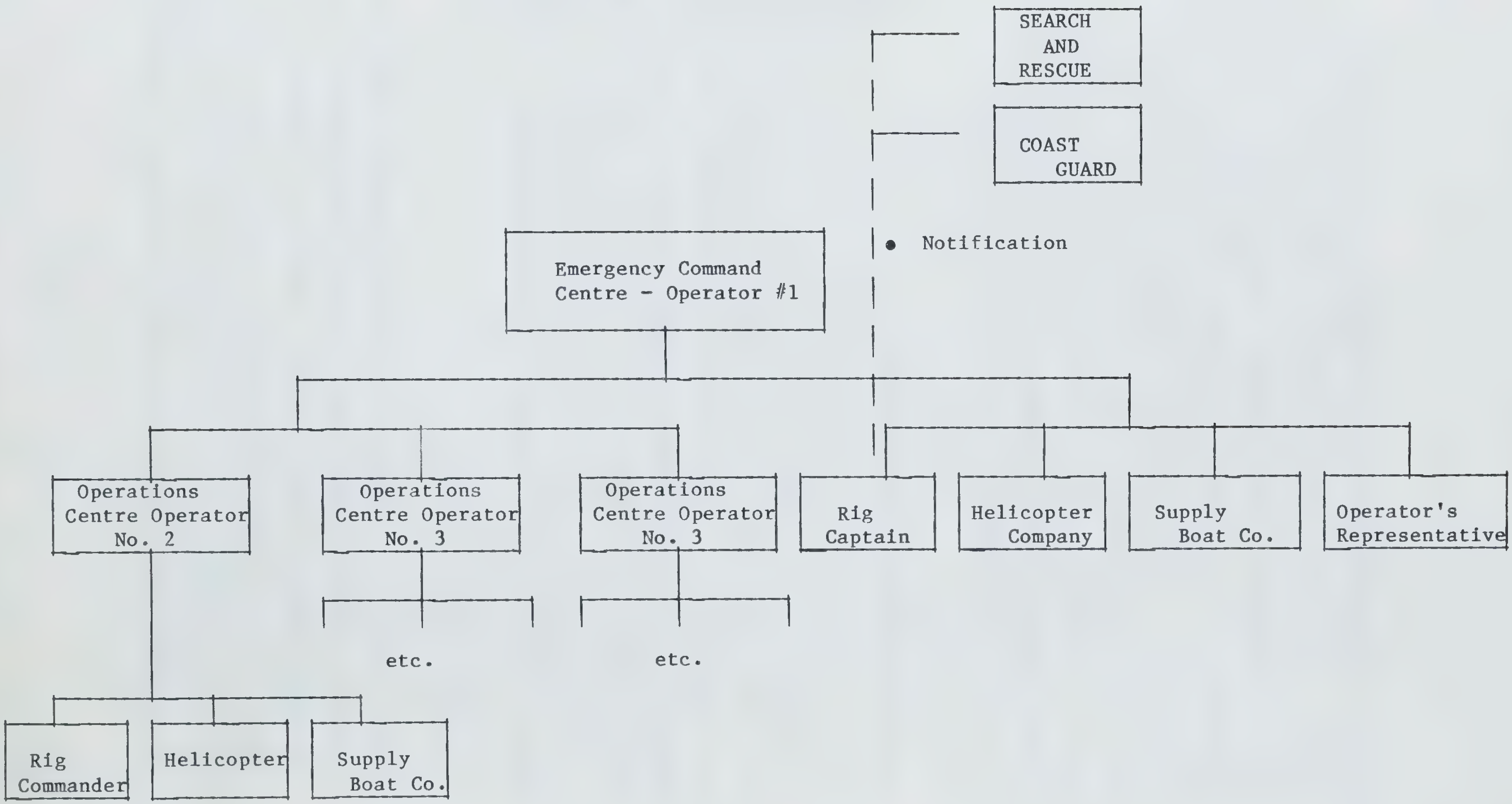
B. REMOTE LOCATION VS. MULTI-OPERATOR AREAS

The command structure, as defined in the terms of reference, includes all elements of the drilling system. We interpret that to mean all elements which are able to supply assistance, and therefore include as part of the drilling system, not only rig based personnel, shore based operator and contractor personnel, and supply boat and helicopter companies under contract to the operator of the rig in question, but also other operators in the area, helicopter and supply boat companies/crews under contract to other operators which might supply assistance, COGLA, Search and Rescue, and the Coast Guard.

1. Remote Location Drilling

When drilling in a remote location, such as the Davis Straits, the command structure is much simpler because other Operators, Search and Rescue, and the Coast Guard are in effect not present. A chart showing a typical remote location drilling organization is shown on the opposite page. Such command structures must be much more self-sufficient. In such situations, the Operator is obliged to maintain a supply base to service all the needs of the drilling

MULTI[illegible]RATOR ORGANIZATIONAL MODEL



*Operator #1 is the operator experiencing the emergency

rig. There is no direct recourse to immediate assistance from other operators, the Coast Guard, or Search and Rescue. All communications are funnelled through the Operator's shore based support centre. All helicopter, aircraft, supply boat, and other marine rescue craft which might be of assistance are under the direct control of the Operator in question. Such total system command structures are simple in nature and as a result are more easily coordinated.

2. Multi-Operator Exploration Areas

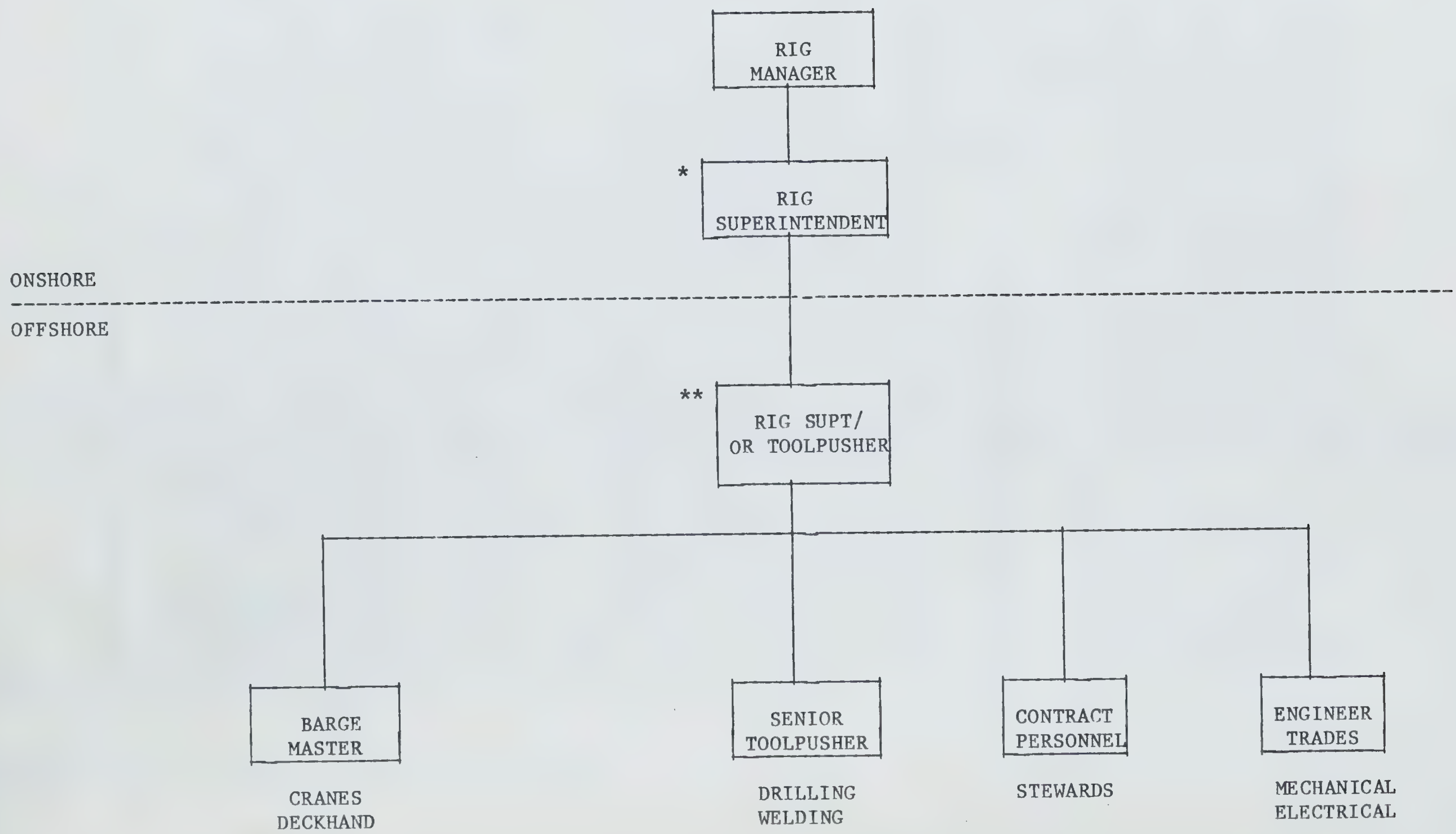
In areas such as the Grand Banks off Newfoundland and the Scotian Shelf, where several operators are present, there is a clear need for the development of mutual aid responses which can increase overall response capabilities. In addition, in areas closer to population centres Search and Rescue, the Coast Guard and other governmental agencies are in a much better position to provide aid. The relationship with such agencies and units in the area becomes more critical. A chart showing a typical command structure for a multi-operator area is shown on the opposite page.

In the North Sea, where drilling was more intense than in Canada, the operators developed joint emergency response plans to provide mutual aid - commonly known as the North Sea Sector Club. The east coast of Canada offers somewhat lesser opportunities for joint emergency response activities than either the North Sea or the Gulf of Mexico because drilling activity is less intensive now and rigs tend to be located farther apart. Nevertheless such interactive mutual aid can play a significant role in emergency situations and since the Ocean Ranger disaster, much progress has been made in exploiting this potential.

The exploitation of the mutual aid possibilities requires

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: JACKUP



* IN SOME CASES THIS POSITION IS STATIONED ON THE RIG.

** USUALLY POSSESSES MARINE & U.S. COLUMNIZED TICKET

effective policies and procedures. This is particularly critical because the units are not all under the control of any one operator or agency. As the number of individual units in the "drilling system" increases so do the requirements for effective coordination and operating guidelines. This factor is now being recognized in the joint operator alert plans recently developed by the East Coast Operators.

C. COMMON COMMAND STRUCTURE FOR A JACK-UP RIG

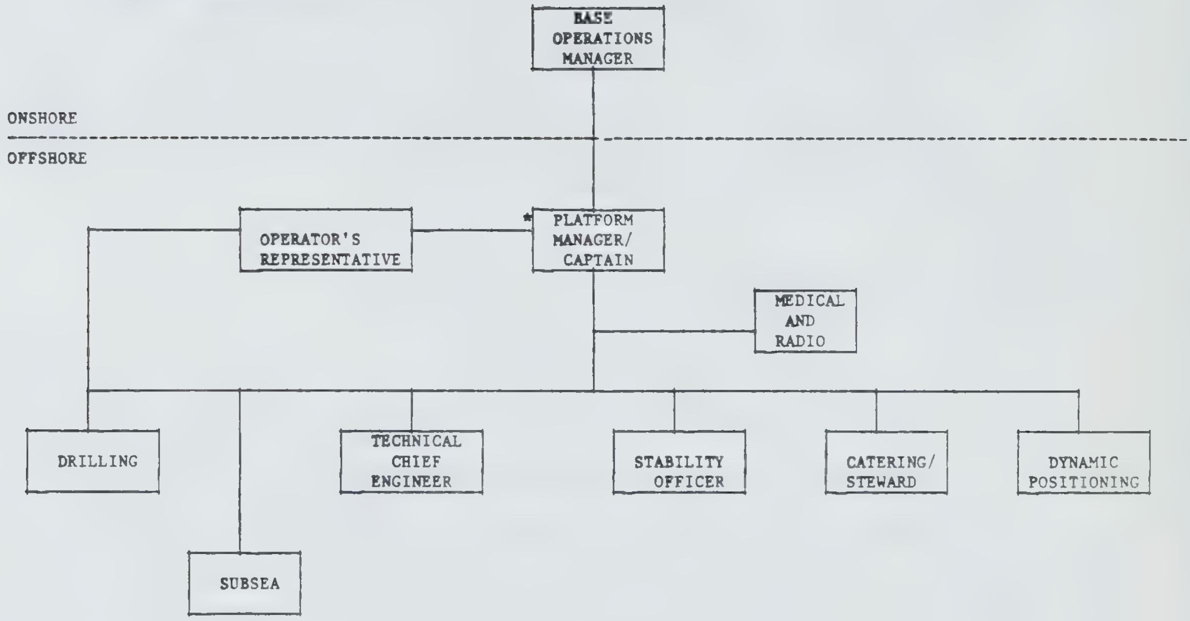
A jack-up rig is regarded as a marine vessel while under tow, and during such operations is under the charge of a barge master or rig mover who is an experienced marine individual. A certified rig mover representing the insurance company is usually also present in order to monitor moving operations and to represent the interests of the insurance company. When a jack-up rig is stationary and in position, it is regarded as a drilling rig and not as a marine vessel. At that time there is a formal sign-over procedure which transfers responsibilitiy for the rig from the rig mover to the senior drilling person. A drilling superintendent is then in command, is responsible for all drilling operations, and has complete responsibility for all elements of the personal safety of the crew. This structure generally corresponds to that found in land based drilling operations. A typical organization structure for a jack-up rig is shown on the opposite page. Normal and emergency responsibilities for jack-up structures are described in more detail in Appendix VII.

D. COMMON COMMAND STRUCTURES FOR DRILL SHIP OPERATIONS

A drill ship is legally subject to the Canada Shipping Act which requires a master with unlimited master marine foreign-going papers to be in charge. In addition, the drill ship behaves at sea much as any other vessel does and for this reason, operators and contractors are

DESCRIPTION OF DIFFERENT COMMAND
STRUCTURE MODELS

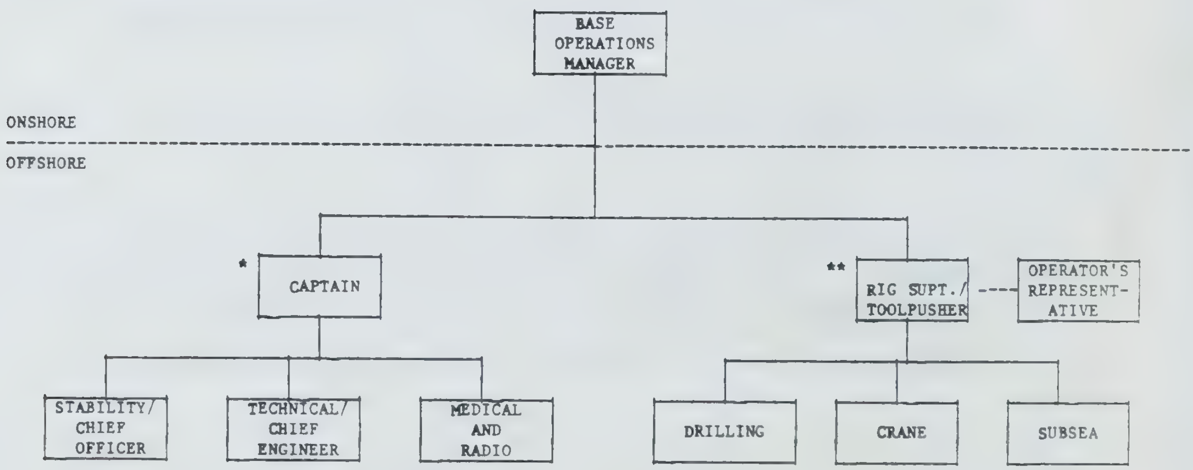
RIG TYPE: DRILL SHIP -
DYNAMICALLY POSITIONED
MARINE COMMAND



* THE CAPTAIN (OR PLATFORM MANAGER) IS IN COMPLETE AUTHORITY IN ALL SITUATIONS; WHILE THE SHIP IS UNDERWAY, STATIONARY AND DRILLING, AND IN EMERGENCY SITUATIONS.

DESCRIPTION OF DIFFERENT COMMAND
STRUCTURE MODELS

RIG TYPE: DRILL SHIP -
ANCHORED - SHARED COMMAND



*CAPTAIN RESPONSIBLE FOR THE SHIP WHILE MOVING AND IN THE EVENT OF AN EMERGENCY WHICH MAY ENDANGER THE PERSONNEL AND SHIP.

** THE RIG SUPT. AND CAPTAIN SHARE EQUAL RESPONSIBILITY WHILE DRILLING.

virtually unanimous in their belief that such units should be commanded by a captain. There are two types of drill ships and the command structures generally vary depending on the type.

- The dynamically positioned drill ship is maintained in position over the drilling hole by thrusters. For such ships, positioning of the vessel requires marine skills at all times when the vessel is operating. These skills are critical to the success of the drilling operation. For this reason, the captain or master in most cases is in overall command at all times.

- The second type of drill ship is one which is anchored during drilling operations. The operational control on these vessels may change depending on whether the ship is underway or anchored for drilling operations. While underway the captain is in overall command. While drilling however, overall responsibility may vary:

    - In some organizations the captain remains in total command

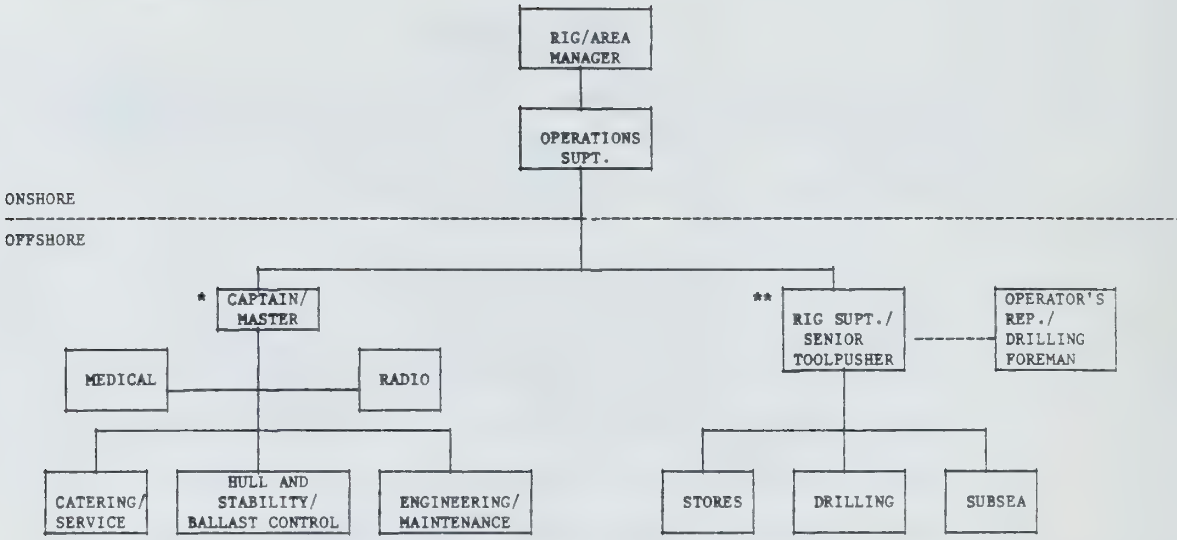
    - Others specify that the rig superintendent is in charge

    - Still others indicate that the responsibilities are shared. In the latter case the captain is responsible for station keeping and general safety of the ship and crew while the rig superintendent is responsible for safe drilling operations.

  In all of the above organizational structures, if the safety of the ship or the crew is in danger, the captain will re-assume overall command and responsibility for the safety of the ship and the crew. Typical organization charts for the anchored and dynamically positioned drill ship command structures are shown on the opposite page. Appendix VIII describes in more detail common command structure types for drill ship operations.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE - "NORWEGIAN" MODEL; "CANADIAN" VARIATION



* CAPTAIN HAS ULTIMATE AUTHORITY WHILE THE RIG IS MOVING, IN EMERGENCIES, AND GENERALLY FOR THE SAFETY OF THE PERSONNEL AND THE RIG. UNDER NORMAL DRILLING OPERATIONS, THEY REPORT ON A FUNCTIONAL BASIS TO THE SENIOR TOOLPUSHER.

** THE RIG SUPT/SR. TOOLPUSHER IS NOT REQUIRED TO HAVE A RECOGNIZED MARINE RELATED CERTIFICATE, BUT IS TYPICALLY EXPERIENCED IN OFF-SHORE RIG OPERATIONS.

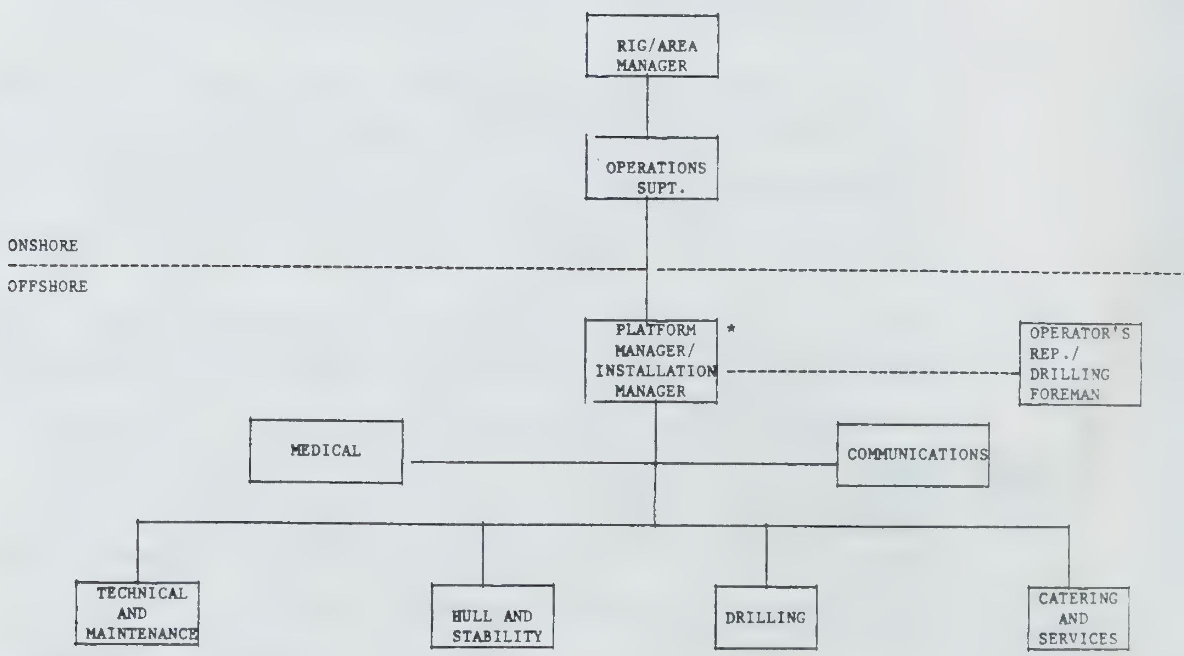
LEGEND:

———————— = COMMAND LINES

- - - - - - - - = FUNCTIONAL OR TECHNICAL LINES

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE "NORWEGIAN" MODEL



LEGEND:

———————— = COMMAND LINES

- - - - - - - - = FUNCTIONAL OR TECHNICAL LINES

* UNLIMITED MASTER'S TICKET. THIS PERSON IS RESPONSIBLE AT ALL TIMES FOR THE NORMAL OPERATIONS, AND THE SAFETY OF THE PERSONNEL & THE RIG UNDER NORMAL AND EMERGENCY CONDITIONS.

E. COMMON COMMAND STRUCTURES FOR SEMI-SUBMERSIBLE DRILL RIGS

Self propelled semi-submersible drilling platforms, whether dynamically positioned or anchored are classified by the Canada Shipping Act as marine vessels. As such the act requires a master mariner to be in command when the rig is operating as a "vessel". However, these structures which are twin hulled and column stabilized do not behave like conventional ships and have complex ballasting systems to maintain stability. Because the skill requirements to effectively command semi-submersible do not conform to either conventional land based drilling nor to normal marine operations, there is much controversy over whether a marine or drilling command structure should reign supreme. All organizations recognize that both marine and drilling skills are required but considerable disagreement exists as to how these skills should best be combined on board such a craft. The situation is complicated further by the fact that not all semi-submersible rigs are self-propelled and hence all do not come under the Canada Shipping Act regulations. Two basic structures may be found.

1. Norwegian Model

The organization structure which we refer to as the "Norwegian model" is more like a conventional marine structure. Typical command structures for the Norwegian model is found on the opposite page. Such structures have a captain with foreign-going masters papers, generally with one or more years previous experience as a first mate on board a semi-submersible. In all such structures the captain will assume command and overall responsibility, if the safety or the stability of the rig is in jeopardy. In the basic Norwegian structure the captain is in complete command of all operations at all times in both normal and

emergency situations. This structure is followed, by a number of contractors on the East Coast in addition to those of Norwegian registry.

In other variations of the Norweigan model the captain is only directly responsible for the marine crew which includes the first mate, ballast control operator, the radio operator, medical staff, chief steward or catering crew, and the engineering and crane operations. The senior toolpusher or rig superintendent is in charge of the drilling crew which generally includes the toolpusher, driller, assistant driller, derickman, roughnecks, sub-sea engineer, and store keeper.

Many command structures of this type indicate that the captain and rig superintendent or senior toolpusher share overall responsibility for rig operations in normal operating conditions. In actual practice the rig superintendent, in many cases, is effectively in command while the rig is drilling and control only passes back to the captain when there is a non-drilling emergency situation.

In some organizations, both individuals report to a common boss - an operations superintendent on shore. In others, the captain may report to a senior marine individual on shore while the rig superintendent reports to a senior drilling person.

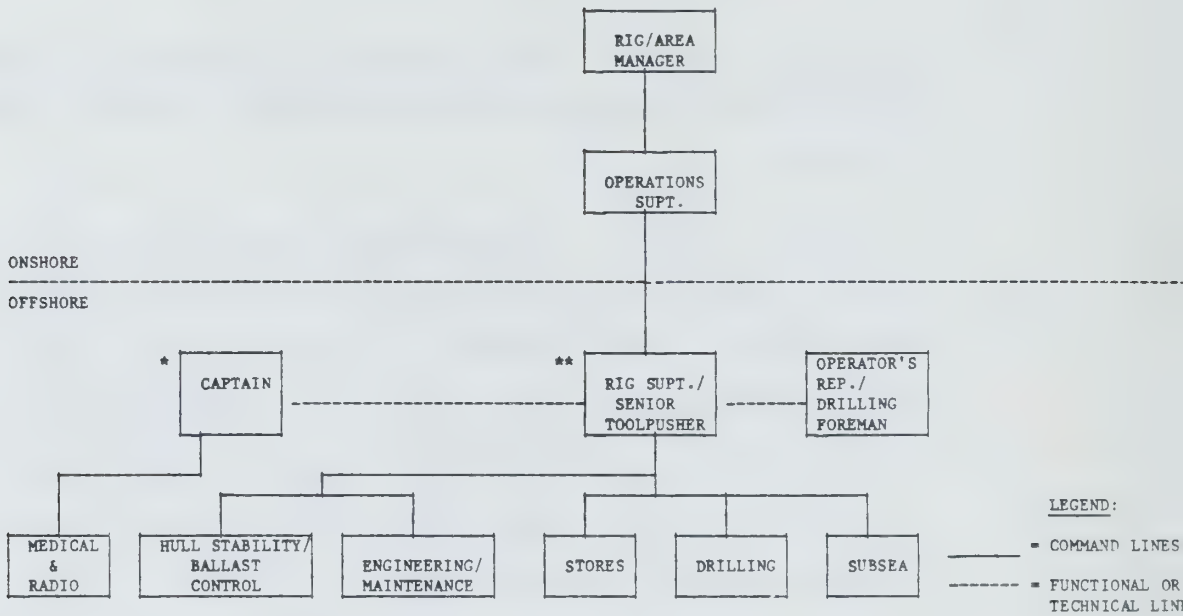
This type of organization and the common variations found is described in more detail in Appendix IX.

2. American Model

The command structure which we refer to as the "American model" is under the overall command of a drilling superintendent for both normal and emergency operations. Such individuals have usually been trained in drilling operations over a long period of time.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE
"AMERICAN" MODEL - 1

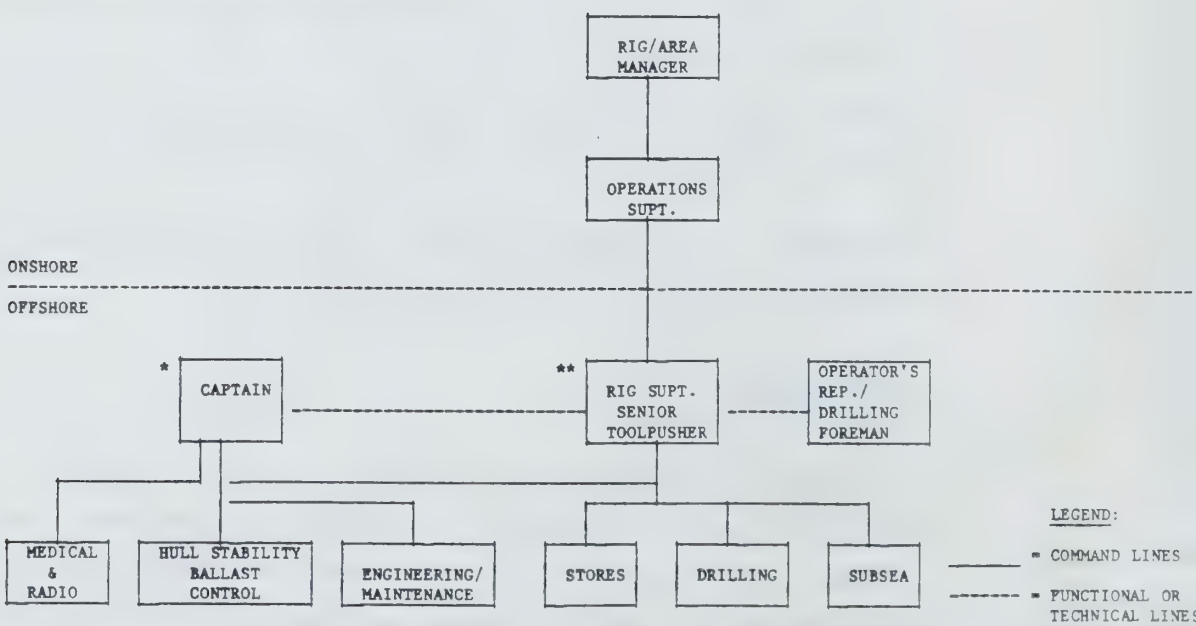


* THE CAPTAIN COMMANDS THE RADIO AND MEDICAL OPERATIONS, AND PROVIDES FUNCTIONAL ADVICE TO THE HULL STABILITY, ENGINEERING AND DRILLING OPERATIONS.

** THE SUPERINTENDENT OR SENIOR TOOLPUSHER HAS A U.S. COLUMNIZED AND MARINE TICKET. IN AN EMERGENCY AND DURING NORM OPERATIONS, HE ASSUMES OVERALL RESPONSIBILITY FOR THE OPERATIONS AND THE SAFETY OF THE PERSONNEL AND THE RIG.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE
"AMERICAN" MODEL - 2



* THE CAPTAIN IS LEGALLY IN COMMAND OF THE VESSEL. HE MAY DECLARE A STATE OF EMERGENCY IF HE BELIEVES THE SAFETY OF THE PERSONNEL & RIG ARE JEOPARDIZED. UNDER NORMAL CONDITIONS, HE IS FUNCTIONALLY RESPONSIBLE TO THE SUPT./SR. TOOLPUSHER.

** THE SUPT./SENIOR TOOLPUSHER HOLDS A U.S. COLUMNIZED AND MARINE TICKET. HE MAY DIRECTLY COMMAND THE HULL STABILITY AND ENGINEERING GROUPS.

In addition, they have been qualified in marine operations and have received a U.S. Columnizied Master's ticket. Some controversy exists as to whether the U.S. Columnized Master's ticket provides sufficient marine training and experience for the hostile North Atlantic environment. Often their background may have been in more quite waters such as the Gulf of Mexico, and therefore, they may not have the appropriate knowledge to deal with conditions off Canada's east coast. Typical organization structures for the American model are found on the opposite page.

In Canada rigs operating in this mode and flying the Canadian flag, (as required by the Canada Shipping Act) must have a captain with foreign-going masters papers on board. Generally, the captain is in direct control of medical staff, radio operations, and provides functional guidance to the barge supervisor.

Although, in most command structures of this type the drilling superintendent has overall responsibility both in normal and emergency situations, some Operators have requested their Contractor to place the captain in command in emergency situations. This structural form, however, is not common.

The preceding paragraphs have outlined the two basic types of command structure for semi-submersible rigs. However, because of the lack of agreement on the best organizational approach to deal with the unique characteristics and requirements of these types of drill rigs in Canada's North Atlantic there are several variations in the division of responsibilities between the on-board drilling and marine units.

IV. EXAMINATION OF INCIDENTS

The terms of reference for the study require the investigation of two incidents of each of the following types - a major fire on a drilling

unit, the loss of a support vessel, the loss of a helicopter, the loss or disablement of a drilling unit, and the loss of well control. These incidents should preferably be drawn from the Canadian East Coast Offshore Region.

In our proposal we expressed reservations with respect to the quality of incident documentation likely to be available, and the limited number of incidents which have actually occurred in East Coast Canadian Offshore drilling operations. These reservations have proven to be well founded. Most of the incident reports from Canadian sources include only partial information, detail only the barebones activities which took place during the incident, provide limited analysis as to the cause and contributing factors of the emergency situation, and little or no analysis of command structure effectiveness.

No incidents of a major fire had occurred on board a rig in Canadian waters. Additionally, only one report was obtained from Canadian sources regarding a helicopter crash, a supply boat sinking, and a blow-out. A complete list of actual and apprehended emergency conditions in East Coast Canadian waters was not available from any source although a list of incidents involving marine casualties was obtained from Transport Canada for off-shore supply vessels and a similar list was obtained for off-shore East Coast drilling rigs.

The incidents which we have analyzed and the lessons to be learned from this analysis are summarized next.

A. HELICOPTER CRASHES

Only one helicopter crash is known to have taken place in Canadian East Coast waters. Although written documentation on this event was not available an oral report from Okanagan Helicopters was obtained. Although requests were made to U.S. authorities to obtain additional reports from U.S. waters, these were not provided.

1. Event Summary

In 1970 an Okanagan helicopter crash-landed and ended up on its side on the deck of the SEDCO H, a semi-submersible rig under contract to Shell. The Okanagan personnel involved indicated that the emergency situation was dealt with in a very effective manner by rig personnel led by the barge master. All personnel were recovered from the helicopter with no loss of life, the danger of fire was dealt with by promptly by watering down fuel leakage, and personnel were later transported to shore. Communications equipment on-board the rig at that time was subject to interference and communications to the Shell shore base were somewhat vague on what had happened to Okanagan personnel. As a result press coverage of the tragedy indicated that 14 people had been killed, and at one point the next of kin of those involved believed that all personnel on the helicopter had been killed.

2. Lessons to be Learned

This emergency was dealt with in an effective manner by rig based peronnel who had a clear understanding of who was responsible for dealing with the situation and the roles and responsibilities of those involved. The incident demonstrates the importance of a clear command structure and the requirement for an effective and expeditious response by those individuals on the scene.

The incident also demonstrates the necessity for closely controlled centralized communication in order to ensure that proper information is obtained concerning the facts involved in an emergency situation. It demonstrates how in such situations facts can become quickly distorted to the point where they do not resemble the actual circumstances.

B. SUPPLY BOAT SINKING - SEAFORTH JARL

Only one report of a supply boat sinking from East Coast Canadian waters was obtained. Our analyis of this incident is based on the Search and Rescue log sheet report supplemented by interview information. At the time of writing, the Canadian Coast Guard report was not yet available.

Additional reports of supply boat sinkings were requested of U.S. authorities but were not provided.

1. Event Summary

The Seaforth Jarl a Seaforth Fednav supply boat, on contract to Petro-Canada but under charter to Mobile Oil, sank off Newfoundland on December 18, 1983. There was no loss of life and all crew members were evacuated safely to life rafts and were subsequently taken on board the MV Arctic Shiko.

The Search and Rescue report and interview information indicate the following chronology of events:

- A may day was issued by the captain of the Seaforth Jarl that the ship was in danger of capsizing. The alert was received by the Sidney Coast Guard radio. The Coast Guard tasked its vessel the Bartlett and notified Search and Rescue.

- Search and Rescue tasked a Buffalo fixed wing aircraft to assist in the search and also alerted Gander. A second Buffalo was requested to be placed on thirty minute standby.

- The MP Artic Shiko was advised of the Seaforth Jarl situation; the Shiko was forty miles away at the time. Search and Rescue

contacted Petro-Canada and was advised that the Shiko was under charter to Mobile Oil, but that she had been hired to haul chain for Petro-Canada.

- Search and Rescue recieved a request from the Seaforth Fednav supervisor for details of the situation.

- The first Buffalo aircraft was on the scene 2 hours and 10 minutes after the may day was received.

- The French research vessel Croix de Lorraine, 1.5 hours from the scene, advised Search and Rescue that five people were safely on board a life raft. Shortly after it was reported that the remaining six people were on board a second raft.

- A Search and Rescue super puma helicopter was scrambled and readied to leave for the site. Petro-Canada advised that it had a helicopter in Marystown ready to leave in 35 minutes. The Croix de Lorraine advised that she was on the scene at 2029 hours.

- At 2045 the Search and Rescue Buffalo aircraft reported sighting flares from one raft; the Arctic Shiko arrived on the scene.

- The marine rescue subcentre appointed the MV Cavallo as the on scene commander.

- The MV Artic Shiko reported being along side one life raft and near the other. At 2225 hours the subcentre reported that all people were on board the Shiko and that the Seaforth Jarl had sunk. The buffalo aircraft was advised to return to base and the Seaforth Fednav office called to get confirmation from the MV Cavallo that the Jarl had sunk.

- Search and Rescue was advised by the MV Arctic Shiko at 2310 hours that her estimated time of arrival in Halifax with survivors would be the next morning.

The incident took about five hours to resolve successfully with all personnel from the MV Seaforth Jarl saved.

2. Lessons to be Learned

In this instance the Captain communicated directly with the Coast Guard (who immediately relayed the message to Search and Rescue) as soon as he was aware that his ship was facing a potential disaster. This communication on a direct basis from the Captain to those elements in the command structure best able to supply aid and assistance resulted in an immediate response by the Coast Guard's vessel, the Bartlett, and a well coordinated search effort led by the Search and Rescue coordination centre.

The incident also points out the importance of assistance from other operators and vessels in the area. The other vessels in the area including the MV Cavallo, the MV Arctic Shiko and the Croix de Lorraine all provided assistance. Their efforts were coordinated by the Search and Rescue coordination centre.

C. LOSS OF RIG STABILITY

A number of brief reports are available convering the potential loss of rig stability. These include the attempted evacuation of the West Venture in 1983, the supply boat rig collision involving the Borkum and the Glomar Labrador I, the John Shaw/Stad Manerva collision in August of 1983, the Rowan Juneau/MV Wimpey Seahunter collision which occurred in September, 1983 and the SDS Vinland/MV Seaforth Commander collision In September of 1983. These reports are all very brief and provide few insights to requirements for command structure effectiveness. In addition, more complete reports of the evacuation of the Euro Princess and Rowan Juneau were obtained from the Canadian

Coast Guard and Search and Rescue Halifax. We have provided in this section an analysis of the Euro Princess/Rowan Juneau evacuations and the attempted evacuation of the West Venture. Additionally, we have provided brief summaries of the other incidents mentioned.

1. Euro Princess - Rowan Juneau Evacuation

a) Event Summary

In November of 1981 the Lyberian Bulk Carrier, the Euro Princess encountered very rough seas, subsequently grounded at 1415 hrs. on the East Bar of Sable Island, and then came free and began drifting southward and threatening the rig Rowan Juneau. The main details of the incident are as follows:

- The MV Balder Hudson, stand-by vessel at the drill rig, observed the Euro Princess on radar and shortly afterwards sighted her distress rockets. Several attempts were made to contact the vessel by radio on various channels without success. The Balder Hudson transmitted a may day giving the position of the Euro Princess to Halifax Coast Guard which relayed the message to the rescue coordination centre.

- The Balder Hudson approached the Euro Princess which was now drifting towards the rig, Rowan Juneau and fired a rocket line with the intention of running a tow line to pull the vessel clear. However, the line was broken due to the severe weather conditions. The Balder Hudson was requested by the Master of the stricken ship to evacuate his crew. Evacuation attempts were made by the Balder Hudson which were unsuccessful due to the heavy weather. These resulted in damage to the Balder Hudson's starboard side.

- At 2310 hrs. the first Search and Rescue helicopter

arrived, followed by a second at 2350 hrs. At 0012 hrs. all of the Euro Princess's crew had been rescued and air-lifted to Sable Island.

- At 0225 hrs. and with the drill rig still threatened the helicopters began air-lifting the crew from the Rowan Juneau and by 0329 hrs. a skeleton crew of 18 persons remained, 44 persons having been removed.

No loss of life and no casualties were incurred mainly due to the courage of the Search and Rescue pilot who evacuated both the Euro Princess and the drill rig in extremely adverse weather conditions. An additional factor which contributed to the success of the rescue was the placing of a rescue specialist on the Euro Princess in order to ensure the helicopter evacuation was carried out in the safest manner possible.

b) Lessons to be Learned

A number of lessons can be learned from this incident including:

- Communications equipment aboard the Euro Princess did not function and for all intents and purposes the vessel was dependent upon others in the area to communicate and to coordinate the rescue attempts. The MV Balder Hudson radioed the distress directly to Halifax Coast Guard. The MV Balder Hudson acted as On-Scene Commander and provided continuing and timely radio reports which kept the Rescue Coordination Centre updated. The Search and Rescue special report on the incident cites this timely communication as being of great assistance. The incident demonstrates the importance of providing such information on a timely basis.

- The same report also praises a number of individuals from Sable Island who lit the helicopter pad on the Island with their vehicle lights and assisted the Search and Rescue helicopter with a difficult manual refuelling and provided accommodation for the persons evacuated. This underlines the importance of providing well located helicopter refuelling and evacuation landing sites, and medical and accommodation facilities in areas where rigs are operated.

- Communications during the incident occurred directly between the Rowan Juneau and the MV Balder Hudson, that is, those vessels directly involved in the rescue and the Search and Rescue Coordination Center which was the element in the command structure best able to provide direct assistance. The incident demonstrates the importance of direct operational communications between the party providing assistance and those on the scene.

2. <u>Attempted Evacuation of the West Venture</u>

Our investigation of this incident is based on a written report dated March 2, 1983 by COGLA entitled "Inspection of the West Venture Drilling Unit" supplemented by interview information from COGLA personnel.

a) Event Summary

The principal activities which occurred are listed below:

- At 1220 hrs. February 16 an iceberg was sighted by the support vessel Kreuzturm. Its location was 27 nautical miles from the West Venture and was moving at .6 knots in the general direction of the rig.

- Weather conditions were beginning to deteriorate and it was decided to secure the well, and pull anchors to more sheltered waters. The drill string was hung off in the well head and the marine riser disconnected. An attempt was made to start pulling anchors earlier in the day, but the wave conditions made the operation extremely hazardous. A decision was made to sit out the storm.

- The West Venture with its 10 anchors proved to be very stable and at no time was there any risk to the unit or the personnel as it sat out the storm.

- An evacuation of the rig personnel was attempted on the morning of the 17th but the two helicopters were unable to locate the rig due to poor visibility and a weak beacon signal. They returned to St. John's.

b) Lessons to be Learned

The people on board the rig initially felt secure in the storm. However, when they heard that an evacuation attempt was going to be made and that helicopters were sent out but then had to turn back because of the weather, a great deal of concern and worry was raised. The incident indicates that perhaps a more fearful situation can result if attempts are made to exercise an emergency procedure which cannot ultimately be fulfilled.

The West Venture was operating under the Norwegian flag at the time and, as such, required that the Captain be the ultimate commander. In theory the Captain could order or decide against evacuation in terms of his assessment of the conditions at the time. However, it appears that because

shore base did order the evacuation, the Captain thought fit to go along with these orders at the time. Interview information indicated that the rig did not call the shore base for assistance, but rather that the storm warning tracking system, which is monitored both by rig personnel and by those on-shore, was the basis for shore command to order the evacuation.

3. Brief Summaries of Other Incidents

Reports were also obtained on the collision between the Stad Manerva and the John Shaw which occurred on August 13, 1983. The report indicated that the Stad Manerva backed into the side of the rig to receive a package for transfer to Halifax. A generator malfunction occurred which rendered turbo-electro control of steering and engines impossible. During this period the vessel turned to port and collided with numbers 1 and 2 port columns on the rig. Both columns and the diagonal brace were dented by the impact of the Stad Manerva. After a thorough inspection of the damage and the determination that there was no threat to the integrity of the Mondu operations resumed on the Mondu.

A second report was obtained concerning a collision between the Rowan Juneau and the MV Wimpey Seahunter which occurred September 1, 1983. The report indicated that the Seahunter after receiving a package, and while maneuvering away from the Mondu hit the outboard side of the port leg three-quarters of a metre above the water with its aft end. The leg of the Mondu received no damage and the Wimpey Seahunter received two small teeth marks on the number 20 ballast tank which caused two very small holes.

An additional report was received concerning the collision between the S.D.S. Vinland, a semi-submersible rig and the MV Seaforth Commander. This collision occurred on September 3, 1983. The report indicated that the vessel dropped one anchor, backed in

stern to, and moored one line to the forward end of Vinland. The vessel commenced offloading bulk chemical, fuel and drill water. At approximately 1550 hrs. a high wave in excess of 5.5 metres came through. The vessel heaved and struck the centre column on the starboard with its fantail. The damaged area was 2 1/2 metres square. There were no leaks.

Another collision was reported between the Glomar Labrador I and the MV Balder Borkum, January 8, 1984. At the time of the accident, the Glomar I was drilling and the MV Balder Borkum was backing into the starboard side of amidship when the electrical generator shut down. The loss of power resulted in the loss of control of the thermo electric pump which operates the variable pitch propellers. The momentum of the vessel continued to carry the stern under the rig. The Borkum regained partial control and only its antenna/radar mast collided with the Mondu's starboard side. The Balder subsequently modified all their supply vessels to prevent similar accidents.

All of the above reports are extremely brief; they provide only a bare bones outline as to the facts involved, and no lessons can be drawn from them.

D. BLOW-OUTS

Only one Canadian blow-out is known to have occurred, the Vinland Shell blow-out which occurred off Sable Island on February 23, 1984. Our analysis of this incident is based on the Search and Rescue log sheet, and interview information obtained from Shell and Search and Rescue personnel. At the time of writing the Coast Guard/COGLA report and investigation of the incident had not been completed.

Additionally, we received reports from U.S. Coast Guard on a well blow-out on the mobile off-shore drilling unit Marlin XIV which occurred on August 31, 1980. We have included a report on this

incident as well.

1. Vinland Blow-out

a) Event Summary

The sequence of events which occurred is as follows:

- At the first sign that a blow-out was in progress the Shell foreman and the toolpusher suggested to the Captain that all non-essential personnel be evacuated. At this point, the Captain took over command.

- The Shell foreman called his shore-based superintendent to advise of the blow-out and that an evacuation had been decided upon. The rig radio operator contacted the Canadian Coast Guard to advise that a blow-out was being experienced. He shortly thereafter signalled a may day.

- The drilling superintendent then called Shell's emergency command centre. The emergency command centre kept in touch with the stand-by boat and considered putting the crew in the supply boats, however, the rig lost its power so this could not be effected.

- Search and Rescue and the Canadian Coast Guard meanwhile scrambled their boats and helicopters and alerted their fixed wing and helicopter craft.

- The decision to evacuate rig personnel to survival boats was made primarily by rig management.

- Other decisions which were made by Shell's emergency command centre with input from the rig included the following:

- because of heavy seas, evacuate personnel from life boats only in daylight

- activate the Atlantic Off-shore Marine Assistace Program (medical advisory aid). By radio doctors talked to people in the lifeboat which contained the heart attack victim. It was decided not to winch the victim out of the boat because seas were to heavy and the act could have endangered everyone on board.

- have the supply boats shepherd the two life boats to the lee of Sable Island and evacuate the personnel only at first light.

- The emergency command centre people were so busy dealing with the problem at hand that the emergency command office only called one other operator for assistance. Others heard the may day and called into Shell's office to offer help. Husky and Mobil both diverted stand-by boats to the scene.

- Search and Rescue had put four helicopters in the air but called them back when they had determined that all rig personnel had safely put themselves aboard the life boats and were under surveillance of two stand-by boats. At about the same time, Shell called its own chartered helicopter back to base.

All crew were safely transferred to the Seaforth Commander and the Claymore Sea from the lifeboats at the first light of dawn. The medical case was taken to the rig of the Zapata Scotian and was then airlifted to the Victoria General Hospital. In all the evacuation took about 40 minutes to effect after a blow-out had been determined.

b) Lessons to be Learned

The following lessons can be draw from this situation:

- The immediate decisions on abandonment were made on the scene in cooperation between the drilling and marine elements. Advice only, was provided by the base command regarding how people were to be removed from the rig. The final decision was properly made on the scene by the people who were most conversant with the prevailing conditions.

- There seemed to be no problem in the Captain assuming command and acting upon input from the drilling element. One can assume that transfer of command was well understood by all on board and was effected in accordance with the situation.

- The multi-operator response plan worked effectively and helped to ensure that the incident was dealt with well. This is particularly true since all the operators but one offered assistance on their own accord upon hearing the mayday from the Vinland.

- Search and Rescue reacted quickly to the problem and had their first helicopter on the scene in 2 hrs. 40 mins. Evidence indicates that there are requirements for both Search and Rescue and the Coast Guard to become more familiar with the operational aspects of drilling and the significance and dangers involved in a blow out situation. This suggests that all elements especially those whose business is not drilling and who are in a position to give aid to a rig need to be made sufficiently conversant with the key dangers, such as a blow-out, which a rig may suffer.

- An additional problem of Search and Rescue helicopters not being able to communicate by radio to the supply boats was a severe handicap in rescue operations. We understand that Search and Rescue helicopters are now being equipped with improved communication equipment.

- The Search and Rescue report indicated that a doctor from the Victoria General Hospital was unable to meet the helicopter when it arrived at Windsor Park with the heart attack victim. A Department of National Defence doctor was made available. The shore based medical assistance program ought to be reviewed and upgraded where appropriate.

2. Marlin XIV Blow-out

a) Event Summary

The Marlin XIV experienced a well blow-out on August 31, 1980 while drilling in the Sabine Pass, Block 11 off the Gulf of Mexico. Injuries to five people were experienced.

The principle events included the following:

- On August 30, 1980 difficulties with the well began to develop and the platform was placed on emergency stand-by. When the well blew out the toolpusher and person in charge of the platform issued an evacuation order.

- The barge engineer on the Marlin XIV had worked on the Marlin several times and participated in emergency drills on his previous shifts. His abandon ship station was in charge of operations of the starboard survival capsule. Upon arriving at the heliport, the barge engineer seeing

debris flying through the air and the evacuation going on, panicked and jumped off the heliport into the water where he was later picked up by a boat.

- The cutting washer supervisor was assigned to the starboard capsule. When the blow-out occurred he went to the quarter's area and up to the heliport. Upon arriving at the heliport he noticed the capsules had departed. He then proceeded down to the escape ladder, couldn't lower it, and jumped off the heliport into the water where he was later picked up by a boat.

- One of the roughnecks on board sprained both ankles while running to escape.

- Two of the food services personnel proceeded to the starboard capsule to which they were assigned. They were told it was full and when they proceeded to the other capsule it had already departed. They then proceeded down the escape ladder, and as it extended only 10 feet down, they dropped approximately 30 feet into the water where they were later picked up by boats.

All forty-five persons on board the Marlin were picked up by boats and taken into safety.

b) Lessons to be Learned

The report by the United States Coast Guard indicates that lack of leadership and adequate emergency training, as evidenced by the fact that the man in charge of operations for the Starboard Survival Capsule jumped from the heliport when the survival capsules were still being loaded, were contributing factors to the injuries sustained.

Lack of adequate emergency training was also a factor as evidenced by the fact that no one knew how to lower the emergency escape ladders.

The incident points out the necessity for a firm chain of command, for experienced leadership, and for emergency drills in which all have participated and which provide the basis for a disciplined response in emergency situations.

E. FIRE ON BOARD

No incident reports were obtained from East Coast Canadian Offshore drilling concerning major fires. It is not believed that any major fires have been experienced in East Coast Canadian drilling. One report was received from the United States Coast Guard and it is analyzed in the following paragraphs:

1. Event Summary - Drilling Rig Diamond M33

On April 18, 1983 the drilling rig Diamond M33 experienced a major fire while drilling in Timbalier Bay in the Gulf of Mexico. Bad burns were experienced by five individuals. The sequence of events was follows:

- Rig 33 was involved in preparing a well for production. Prior to the blow-out a flow of mud was experienced through the last three strands. A well kill operation was commenced. On April 18th preparations to begin circulating the kick out of the well were complete and the pumping operation began.

- About one-half hour after pumping began, the drilling foreman noticed the first sign of gaseous mud returns. The bulk of the gases contained in the returning mud were separated and vented to the atmosphere through the vent stack.

- A significant volume of gas began to be experienced. The drilling foreman completed an inspection and was satisfied that there was no build up of gas in the spaces on the rig. A no smoking order was put into effect. No consideration was given to shutting down the generator or prime mover engines and using emergency lighting.

- When the on-line generator lost power, an arc or arcs from the circuit interrupting devices (opening due to undervoltage) probably provided the ignition source for the flammable gas concentrations that had been built up. A major fire resulted.

- All 21 persons on the rig escaped. Five persons were found to be burned and there were no other reported injuries. The drill rig was a total loss.

b) Lessons to be Learned

The United States Coast Guard report indicated neglect on the part of the toolpusher in that he failed to make himself adequately aware of the level of gas concentrations; he failed to shut in the well in light of the volume of escaping gas; and he failed to evacuate the rig in a timely fashion when he knew or should have known of the dangerous accumulation of gas on the rig.

Additionally, there were no formulated safety plans for dealing with the dangers of accumulated gas on a rig. The rig's open construction made such a contingency a distinct possibility; one that could be reasonably anticipated and dealt with effectively if such plans were prepared in advance and utilized.

This incident points out the need for indepth training of those individuals in command in order to appreciate the dangers involved in potential blow out situations as well as the knowledge to take preventive action. Additionally, it points out the need for carefully formulated safety plans for dealing with potential blow out situations.

Although considerable difficulties were experienced in obtaining incident documentation, the information obtained does indicate the importance of a firm chain of command, leadership qualities amongst those involved, and for thorough training programs and well formulated and widely understood contingency plans.

V. CRITERIA FOR EVALUATING THE EFFECTIVENESS OF EAST COAST DRILLING COMMAND STRUCTURES

The criteria which we have utilized in evaluating the effectiveness of command structures for offshore drilling are based on our in-depth knowledge of sound organizational principles and contingency planning; they have been substantiated and tested by examining the behaviour of organizational structures in actual emergency incidents as described in the previous section; and they have been reviewed with knowledgeable individuals in the drilling industry.

In the following sections we cite the criteria and discuss some of the factors which we considered important in establishing each criterion. We have found that a common set of criteria can be applied to judge the effectiveness of the different command structures for all five incident types.

A. CRITERION I - COMPETENT AND TRAINED PEOPLE

Organizations are only effective when individuals in the organizational unit at all levels have the required knowledge and

training to do their job properly. Competence and prior experience becomes particularly important in the offshore drilling industry which must function in an hostile environment and deal with an ever-evolving technology. Emergency situations, when they occur, will challenge the competency of those in charge who must act expeditiously and decisively to ensure the safety of personnel, equipment and the well. In addition, crew members must have faith in the competency of those who lead them if the organization is to function effectively in emergency or potential disaster situations.

There may be individuals in a crew complement who have valuable practical experience in particular situations, such as well control who are not in a senior command position. These people should be identified and included where practical in special emergency response teams.

Further, it is important that each senior command/ advisory or technical position should have adequately experienced and competent back-up.

In evaluating command structures for east coast drilling we will therefore examine the training/competency requirements for key positions and the provision for back-up resources versus standards currently in place.

B. CRITERION 2 - A STRONG UNIFIED COMMAND STRUCTURE

Most successful organizations are designed with clear lines of authority which leave little doubt as to the responsibilities of the key managers in them. Successful organizations tend to reflect the values and leadership of the individual at the top.

In some situations "matrix management" types of structures, where responsibilities are shared between managers, are also implemented

successfully. Such organizations are generally only effective however where a collegial type of atmosphere exists, where there is a strong requirement for multi-disciplinary input for effective decision making, and were much time exists for discussion before decisions have to be made and executed. Technical design teams are examples of organizations where such structures can be effective.

Drilling organizations which face emergency situations require a strong and rapid decision-making structure, instant obedience on the part of crew members, and effective coordination of all elements of the crew by a central authority to ensure safety. Emergency situations demand a take charge authoritarian style of management. Drilling organizations in emergency conditions are similar to military organizations in battle and require a similar organizational structure with a strong unified command.

The requirement for a strong unified command structure does not imply that the person in ultimate command must be fully conversant with all the details of both drilling and marine technology. Advice can be sought from others, but the individual in charge must have sufficient overall knowledge to be able to know when to ask for advice, to know the right questions to ask, to be able to understand and interpret the information received and hence to command effectively.

Organizations, which during normal operations, do not exhibit a strong unified command structure are very unlikely to do so when facing emergency situations. If command is divided during normal operations it could become further divided in emergency situations. Individual crew members will continue to respond to the individual for whom they have gained respect and see as their leader during normal operations. **It is therefore difficult to impose a different structure for emergency situations from that which exists for normal operations. The normal operating structure must therefore be supportive, both in terms of style and division of responsibilities, to that which is required for emergency situations.**

In evaluating command structures for east coast drilling we will examine the extent to which emergency command structures describe a strong unified structure and the extent to which the normal operating mode of the "drilling system" supports a strong unified command.

C. CRITERION 3 - COMMAND STRUCTURES MUST MOVE TO SUCCESSIVE ALERT STAGES

The state of readiness of the command structure must change throughout a potential/actual emergency incident so that the organization has as much time as possible to institute the appropriate response actions.

In many instances the potential emergency can be detected long before the actual emergency happens. For instance, the potential for loss of rig stability can be detected from weather reports and from actual observations of changing sea conditions long before conditions worsen to the point that rig stability is threatened. Similarly, potential collisions with ice bergs can be detected through the observation and tracking of ice movement. As conditions worsen the organization should move through successive stages of readiness. For example, when evacuation may be required life boat teams must be actioned, life boat captains must see to the mustering of crew members on their teams: Immersion suits, life jackets etc. must be readied, so that evacuation can be carried out effectively if required.

In evaluating command structures for east coast drilling we will examine the extent to which emergency response plans prepare all elements of the "drilling system" with as much time as possible and provide for a progressive commitment and marshalling of resources to deal with impending or possible emergency situations.

D. CRITERION 4 - A STRONG SENSE OF ORGANIZATIONAL UNITY/TEAM WORK

We believe that the drilling organizations which are likely to be most successful in facing emergency situations are those which have built

up a strong sense of identity, team work, and a cooperative attitude which respects each other's qualifications. These characteristics are impossible to legislate and must be built up in an organization over a considerable period of time by the right type of leadership and appropriate training.

In drilling organizations different skills - knowledge of the local geology, marine skills, and drilling expertise - must be blended into a harmoniously functioning whole. These different elements - drilling/exploration/marine-come from different backgrounds and it takes time for one element to gain knowledge of and respect for the skills of the other, and for these different elements to become truly part of a unified organization. Additionally, effective leadership on the rig and from the management teams of the contractor and oil company management are required to make this happen.

In examining the effectiveness of command structures we will identify the factors which assist and inhibit the development of this necessary team work.

E. CRITERIA 5 - EFFECTIVE COMMUNICATION PROCESSES

During times of emergency, it is essential that communication links be as short and direct as possible, that communication processes be centralized, and that regular status reporting be maintained.

It is essential that communication links be as direct as possible; preferably they should flow from the commander of the rig or his designate directly to the resources best able to provide and/or co-ordinate assistance. Direct communication is likely to be the most effective as it eliminates intermediaries who have less knowledge of conditions on the rig and are therefore less able to communicate effectively the particular nature of the emergency and most effective action to deal with the situation. It is recognized however, that the

commander on board a rig may not have time to notify and to coordinate communications with all elements that might provide assistance, and that he may not have at his disposal as sophisticated communication equipment as the operator's shore based support centre does. Nevertheless, it is important that he communicate directly with the elements of the drilling system which will supply aid concerning operational matters.

It is also essential that communications be centralized so that all pertinent information is assembled in and disseminated from one place. This will permit decision making to be based on full knowledge and information. Such centralization is essential for the effective coordination of all elements which can provide aid.

Finally, it is necessary that the rig report the status of the emergency situation to the shore base operations center at regular intervals. This will enable elements which can provide aid to react quickly and appropriately, and to remain apprised of the latest conditions and requirements.

In evaluating the effectiveness of command structures particular attention will be paid to the procedures which govern communication processes.

F. CRITERION 6 - EFFECTIVE PROCEDURES TO COORDINATE THE EFFORTS OF ALL ELEMENTS

Effective procedures must exist to coordinate the efforts of all elements which might provide aid in an emergency situation. In multi-operator areas the exploitation of mutual aid possibilities requires effective policies and procedures. As the number of operators, contractors and governmental agencies which might provide aid increase, so do the requirements for effective coordination and operating procedures. This is particularly true since the units in

question are not under the control of the Operator or Contractor experiencing the emergency. The close coordination of other units through the implementation of common alert plans, mutual aid agreements, and detailed operational procedures has been found effective in enhancing command structure effectiveness in North Sea drilling operations. There, operators have formed a mutual aid pact called the North Sea Sector Club.

In evaluating command structure effectiveness we will examine the extent to which existing procedures recently formalized for Newfoundland and Nova Scotia coordinate response actions.

G. CRITERION 7 - EXERCISE OF THE COMMAND STRUCTURE

Exercise of all critical elements of the command structure including:

- marine and drilling elements on the rig,
- supply boats;
- helicopters;
- shore based oil company and contractor personnel;
- the Coast Guard;
- Search and Rescue;
- and other elements which could supply help

is required in order to ensure adequate training and coordination of the various elements in the drilling system.

Exercise drills which are required to ensure that all on board crew are fully trained in the safety procedures include man-overboard, evacuation, fire and blow-out prevention drills. In addition, the operator's helicopter and supply boat companies should be involved and participate in drills to test communication systems and response effectiveness.

Moreover, there is a requirement for other elements which could supply aid to carry out joint training exercises in order to test mutual aid response plans. This later requirement is particularly critical in multi-operator areas.

The observation of the exercise by a trained observer, and subsequent critique of effectiveness and debriefing is an essential ingredient to improve effectiveness.

In evaluating command structure effectiveness we will examine the adequacy of both the on board and wider training exercises.

H. CRITERION 8 - DECISION MAKING MUST BE CLOSE TO THE SCENE OF ACTION

Offshore drilling rigs operate at a considerable distance from their shore bases. It is therefore impossible for shore-based Operator or Contractor personnel to effectively call the shots from shore in an emergency situation. Decisions in an emergency situation must be made by the senior manager on board who has the best knowledge of the situation at hand. Critical decisions must be made rapidly and sometimes without time for consultation.

As stated earlier, the normal command structure for a rig operation must support the structure required in emergency situations and be of a similar type. We therefore believe that command structures during normal operation must be decentralized to the rig to a great extent.

Shore-base resources should be oriented to a supportive role. Valuable information, not available on the rig, can frequently be supplied by the shore base. This will enhance the quality of the decisions which are made on the rig.

In examining command structures during both normal and emergency circumstances we will therefore evaluate the amount of implied

decentralization of authority inherent in the reporting relationships.

There may be other subsidiary criteria which could be applied in evaluating the effectiveness of command structures. However, based on our knowledge of organization structures and on interviews with experienced management and operating personnel in the offshore drilling industry, we are confident that the primary criteria described previously will allow us to properly evaluate and identify areas for improvement in offshore command structures.

VI. GOVERNMENT REGULATIONS

This section briefly describes the government regulations as they relate to command structure effectiveness and comments on the extent to which they support the criteria for effective command structures.

Operators, before commencing drilling operations, are required to obtain a Drilling Program Approval as specified in the 1980 Canada Oil and Gas Drilling Regulations. These regulations include requirements for stand-by craft, lifesaving equipment, meteorological observers and contingency plans to deal with any foreseeable emergency including:

- a serious injury or death of any person;
- a major fire;
- the loss or damage to support craft;
- the loss or disablement of a drilling unit or a drilling rig;
- the loss of well control;
- arrangements for the drilling of a relief well should such become necessary:
- hazards unique to the site of the drilling operation; and
- spills of oil or other pollutants.

Additionally these plans shall provide for coordination with existing local and national contingency plans.

COGLA recently issued Revised Safety Guidelines for East Coast Drilling on December 8, 1983. These revised guidelines contain a number of new measures including requirements for cooperative Regional Alert Plans. These plans must detail the procedures to be used by individual companies to bring management to an enhanced state of readiness when specified alert conditions are encountered.

The guidelines also specify that all drilling units shall have one person on the unit clearly identified as responsible for the safety of the drilling unit and its crew. On floating units this person shall be qualified in marine matters; experienced in drilling unit operations; and possess a recognized master mariner's certificate. This requirement recognizes the need for the person ultimately responsible for safety to make decisions in full consultation with the person responsible for drilling operations.

The Canada Shipping Act specifies that self-propelled drill rigs must be commanded by a Master with an unlimited ticket. The Coast Guard acts as the government's principal agent to ensure that marine regulations are updated and meet current requirements. The Coast Guard has no authority over foreign flag vessels operating outside Canada's 12 mile limits. Regulatory control in these instances is exercised through the licensing process by COGLA.

The provinces of Newfoundland and Nova Scotia also exercise certain control over drilling operations. Local content directives are provincial in nature. Other provincial guidelines tend to be similar to those issued by COGLA.

The revised COGLA guidelines recognize the need for alert stages and joint operator contingency plans. They also recognize the need for unity of

command and for the commanding individual to be experienced in both drilling and marine operations. The guidelines do not however, specify minimum experience criteria for key rig positions. The specialized training qualifications and certification programs required for rig commanders, ballast control operators, first mates, and others is not specified. We believe that this is the single most important area where government regulations can be improved. This requirement is discussed in more detail in the next section of the report.

VI. EVALUATION OF COMMAND STRUCTURE EFFECTIVENESS

This section presents the findings from our evaluation of command structure effectiveness. These are presented with respect to each of the criteria discussed in the previous section of the report.

A. COMPETENT AND TRAINED PEOPLE

Our interviews with Operators and Contractors, the substantial progress which is being made in improving off-shore emergency response plans, and the initiative taken by industry under the jurisdiction of the Canadian Petroleum Association Off-shore Safety Task Force in cooperation with COGLA, demonstrate to us industry's concern with safety matters. Interviews indicate that industry is dedicated to staffing their organizations with competently trained people. Indeed, we believe that Operators and Contractors are diligent in trying to ensure that they have properly qualified people assigned to key positions.

However, the off-shore drilling industry has expanded very rapidly, and the technology for marine drill structures continues to evolve quickly. As a result of this rapid evolution and growth, industry has faced the situation where there is a world wide shortage of individuals trained in off-shore drilling operations and particularly in the specialized marine skills required to command and operate such

structures effectively. Because of these factors, a number of deficiencies have been observed.

1. Trained Marine Skills are in Short Supply

The drilling skills required on an off-shore rig do not differ substantially from those required for land-based drilling. For this reason, there has not been a lack of experienced drilling personnel. However, training programs for drilling personnel have frequently not embraced training in marine skills.

Conversely, the normal marine skills gained through formal training, certification, and experience at sea in conventional vessels do not provide sufficient training to marine personnel for the operation of drill ships and semi-submersible drill rigs. Drill ships, although they behave much like a conventional vessel, require specific knowledge with respect to drilling equipment and procedures for hanging-off and for protection of the well.

The differences in the training requirements for semi-submersible rigs vs. conventional ships is even more marked as they are twin hulled column stabilized vessels. Such rigs have behaviour characteristics which differ significantly from conventional ships. Thus a sound knowledge of the highly complex ballast systems are required in order to maintain the vessel's stability. These rigs, like drill ships, have highly complex drilling equipment on board, and to be fully effective a knowledge of drilling operations is also required by the marine element. Because of the world wide shortage of marine captains, first mates, etc. trained in drilling operations, industry has on occasion been forced to use people with less training and experience than they would otherwise have wanted. This is of particular concern since environmental conditions in the North Atlantic are more severe than in many offshore drilling sites around the world where deck officers may have gained their experience.

In addition to the lack of training of marine personnel in the specific skills required to be effective in drilling operations it was mentioned several times to us by a knowledgeable marine personnel that marine training in Canada for master certifications lacks the depth and breadth of merchant marine tradition and expertise in Europe.

The Newfoundland, Nova Scotia and Canadian Governments have indicated their desire for higher Canadian content at all levels in offshore drilling operations. Specific Canadian content objectives and timeframes to achieve them have been set for all levels of personnel including highly technical staff such as first mates, ballast control operators, and captains. Because of the guidelines foreign highly qualified senior marine and drilling personnel are now reluctant to come to Canada to assume positions in the Canadian offshore drilling industry. They know that their future is limited and that they will be replaced by Canadians.

Interviews with industry officials suggest that forcing rapid accedence to Canadian content regulations on industry is having two effects: it is introducing inexperienced workers, untrained in offshore safety requirements, into the system; and it is forcing industry to undertake considerable additional training. Interviews indicate that industry is willing to undertake the additional training programs but will not jeopardize safety standards.

Furthermore, in qualifying for ON2 certification, a maximum of six months credit is received for time spent aboard a semi-submersible towards the 24 months of sea going time required. This tends to limit the on-board rig experience obtained by master mariners as part of their training time.

The lack of trained Canadians, the worldwide shortage in trained marine crews, and the insistence by government on Canadian content requirements, have combined to make it very difficult for the industry to staff its rigs with highly qualified individuals.

2. Back-Ups for Key Resources Are Also in Short Supply

Knowledgeable people whom we interviewed indicated that back-ups for key marine positions are also in short supply. As noted in the previous section, trained individuals for key positions such as captains and ballast control operators are in short supply on a world wide basis. Because of this short supply, individuals are advanced to these key positions as quickly as possible, thus leaving a significant gap in the numbers of experienced individuals available as back-up.

It was noted that the training and experience levels of individuals in key back-up positions frequently were significantly below that of the individuals they might have to replace in time of emergency. For example, there tends to be a greater experience gap between captains and, say, first mates than would normally be expected in a marine environment.

3. Recognized Training Qualifications do not Exist for Several Positions

Although individual drilling contractors do provide specific training to marine personnel in drilling operations, no certification programs exist in Canada. It would be of great assistance to Operators and Contractors if such certification or generally recognized training programs existed so that they would have assurance that they were hiring personnel with recognized and demonstrated experience in drilling operations.

a) United States Certification Program

In the United States a Columnized Masters Certification Ticket exists to ensure adequate training for rig managers operating semi-submersible drilling rigs. However, only U.S. citizens may hold such certificates. Industry sources indicate that the U.S. Columnized Certification goes a long way to providing the training required for captains of semi-submersible rigs. However, no such similar certification program exists in Canada. Also, there is some controversy over whether the U.S. columnized ticket provides fully adequate marine training for the hostile North Atlantic environment.

b) Certification for Ballast Control Operators

Again, although many drilling Contractors provide training to captains with respect to the complex marine ballast control systems for semi-submersible rigs, no certification programs exist to ensure that such training and qualifications meet standards which are universally recognized by the industry and governments. It is left to the individual Contractor not only to ensure that the ballast control operator is trained, but also to ensure that key back-ups to the ballast control Operator (such as the toolpusher, captain, and first mate) also have sufficient training in ballast control procedures and techniques.

Additionally, no barge master or rig mover's certification program exists.

Operators and Contractors in industry in Canada are planning a standardized ballast control training program. They indicated that the existence of certified programs would greatly assist them in ensuring that their personnel were fully qualified. At the time of writing, the oil industry has

asked the Canadian Association of Offshore Drilling Contractors (CAODC) to establish a program.

c) Marine Survival Training

The growth of the industry in Canada has also required the training of a significant number of drilling personnel,who have been recruited from landbased drilling operations, in marine survival knowledge and techniques. Until recently no industry wide standards for such training were agreed. Recently, however, industry initiated the development of a training program through Survival Systems Inc. in Halifax. The Fisheries College in St. John's Newfoundland has also initiated a program. These programs are generally recognized as meeting the requirements for offshore survival training. The Petroleum Industry Training Service (PITS) at industry's request, is developing training objectives which may serve to certify accepted training programs.

d) Life Boat Captain Training

A number of individuals whom we interviewed indicated that the position of life boat captain was another position for which accredited industry-wide training programs would be beneficial. It was indicated that the command of life boats required more than a mere knowledge of the technical aspects of life boat launching, and that specific leadership skills were required. It was also noted that such training is best done in a controlled situation and when not at sea. Such training therefore lends itself to a specialized off-ship training program. Plans for the development and implementation of this type of course are underway.

There is therefore a critical need to develop recognized training programs in several areas. Preferably, these training or

certification programs should be recognized not only in Canada but also internationally to assist the industry in developing and maintaining highly qualified staff. This is particularly important as experienced crews must be drawn from a world-wide labour pool as there are not a sufficient number of experienced Canadian resources to provide the needed manpower.

4. Government Regulations/Guidelines Do Not Fully Recognize the Specific Requirements of the Industry

The Canada Shipping Act which is administered by the Canadian Coast Guard classifies self-propelled semi-submersible drilling platforms whether they are dynamically positioned or anchored as marine vessels. The situation is complicated further by the fact that not all semi-submersible rigs are self propelled and hence do not all come under the Canada Shipping Act Regulations. Moreover, vessels operating under a foreign flag are subject to the laws of the country whose flag they bear. The Canada Shipping Act requires that a captain with unlimited foreign-going masters papers be in command. As indicated previously, such platforms require specialized marine skills and the existing regulations do not deal with this fact.

Drill ships also fall under the Canada Shipping Act. These vessels, to a lesser degree, also require specialized marine skills and this fact is also not recognized by the existing regulations.

Recently, COGLA provided offshore drilling guidelines which indicated that offshore rigs should be commanded by individuals with experience in drilling operations. However, the specific qualifications and experience requirements are still not spelled out clearly.

There exists a severe worldwide shortage in skilled marine personnel trained in drilling operations because of the rapid growth of the offshore drilling industry. In this context, industry faces a situation where existing government guidelines and regulations are not specifically applicable to the industry and recognized certification programs do not exist. The pressure for relaxation of standards is therefore high in a situation where standards are not clearly defined.

B. STRONG UNIFIED COMMAND STRUCTURE

This section contains our evaluation of the degree to which existing on-board command structure types foster and support a strong unified command structure.

1. <u>The Degree of Unity of Command Achieved is Partially a Function of the Type of Rig</u>

a) Jack Ups

Jackup rigs, except when they are under tow, are under the complete command of the rig superintendent or toolpusher. He is responsible both for drilling operations and for the overall safety of the crew and the rig. When the rig is under tow it is under the command of the rig mover or barge master. When the rig is in position and jacked down, a formal transfer of command takes place. A clear unified command structure therefore exists for such craft.

b) Drill Ships

Most command structures for drill ships also exhibit a strong unified command structure. In many cases, they are under the overall command of a captain who has complete responsibility for the drilling crew and for the overall safety of personnel

and the ship. This is particularly true of dynamically positioned drill ships where the marine element is critical even when the ship is drilling. In such cases the captain is almost always in complete command of all elements at all times.

For drill ships which are anchored while drilling, the captain is in command while the drill ship is moving but frequently command effectively shifts to the senior toolpusher when the ship is anchored and drilling. In some such cases the captain and senior toolpusher are designated as being jointly in charge and are expected to consult on major decisions. Response plans and organization charts indicate that the captain must re-assume overall command if the safety of the ship or personnel are threatened. Few response plans indicate minimum or alert conditions which should trigger a change of command to the captain. This change of command from the captain to the drilling superintendent or senior toolpusher gives rise to a duality of command which tends to weaken the overall unity of the command structure.

c) Semi-Submersibles

Unity of command varies greatly in semi-submersible organization structures. In the "American Model", where the drilling superintendent maintains responsibility for both drilling operations and the overall safety of personnel and equipment, a unified command structure is exhibited.

In the "Norwegian model" however, unity of command may vary significantly. The basic model has a captain or platform manager in charge of all operations on board and a unified command structure is therefore exhibited. However, there are significant variations:

- In some structures the captain and senior toolpusher (or drilling superintendent) share responsibilities, with the captain having overall responsibility for safety in all situations.

- In other structures the captain remains in overall command in theory but in practice it is the drilling superintendent who actually commands in normal operations.

- Unity of command can be further weakened if the senior toolpusher reports to an onshore drilling superintendent while a captain reports to a senior onshore marine person. Such reporting tends to accentuate the division in command between the marine and drilling elements.

Almost all organization structures, which follow the Norweigan model or variations of it, indicate that the captain is to re-assume command when the safety of the crew or platform is threatened. However, few specify minimum alert conditions which are to trigger such a change in command.

Unity of command is therefore strongest, in theory, for the jack-up rig, for drill ships which are dynamically positioned when drilling, for semi-submersibles which follow the basic Norwegian model where the captain or platform manager remains in command of all operations, and for American model.

This comparison of the command structures for different drill rigs and the comparisons of the degree of unity of command achieved does not indicate that we favour one type of command structure over another. The drawing of boxes on an organization chart and the specification of responsibilities is but one element in achieving a strong unified command structure. Mutual respect, effective leadership and a cooperative working environment are equally important.

2. Knowledge and Mutual Respect are Key Contributors to Unity of Command

Drilling operations which utilize drill ships or semi-submersible structures require both marine and drilling skills to be combined into an effective command structure. Such a combination is difficult to achieve because each comes from a different background, each has a different knowledge base, and sometimes different values and attitudinal behaviour.

Most captains come from a marine environment where a more authoritarian structure tends to prevail. Training in the complex equipment required to carry out drilling operations is not received.

Senior drilling personnel, by contrast, often have little technical knowledge of the marine environment and come from a strictly industrial background. Interviewees indicated that in drilling operations senior personnel generally tend to mix into the day-to-day operations of the rig more readily than do marine personnel.

In order to provide effective overall direction the individual in charge must command the respect from those he supervises by demonstrating his knowledge of both drilling and marine operations, as well as his management and interpersonal skills. If such respect is gained from both elements of the rig crew, then a strong unified command structure can exist irrespective of the particular organization structure which is chosen, and irrespective of whether the senior toolpusher or captain is in ultimate command. Such respect is only achieved by those individuals who gain sufficient knowledge of both marine and drilling requirements and who understand the attitudinal and cultural differences in background between individuals in the marine and drilling departments.

3. <u>Divided or Shared Command Can Weaken Response Effectiveness</u>

Several of the command structures for drill ships and semi-submersible rigs are based on a command structure with shared responsibilities, or a command structure where overall authority must change from one individual to another. While such structures can work, the strong unity of command which is required to effectively manage emergency situations can be weakened.

Where command in normal operations is held by the senior toolpusher or rig superintendent, but reverts to the captain in emergency situations individual crew members can become confused as to who is in charge and when. If during normal operations crew members see that the rig superintendent is in command and that he effectively dominates all operations of the rig, they will normally look to him in emergency situations to receive their orders. In such command structures this can be overcome, at least partially, **if the captain plays an active and dominate role in safety drills and in the overall safety program such that he is seen as being the "safety commander", as well as being responsible for the many ancilliary services on the rig.**

Few response plans clearly identify the alert conditions which indicate when responsibility is to pass back to the captain. Certainly most captains will use good judgment to determine whether an emergency exists and hence whether command should be re-assumed. However, the designation of minimum alert conditions where command should clearly be transferred to the captain would be useful in ensuring that senior drilling personnel understand the situations where they are to accede to the captain's direction.

Individual crew members should not perceive the reassumption of command by the captain as unusual if the captain has maintained an <u>active</u> role of the overall "safety commander", if he has commanded

all emergency drills and the complete safety program, and if he exercises command through the regular command structure. Indeed individual crew members should see this as the "normal occurrence of events" and there should be no change in structure at their level as they continue to respond to the superiors they regularly report to.

In some command structures where responsibility is shared, the captain and senior toolpusher report to separate shore-based senior marine and senior drilling personnel. In such cases the command structure is further weakened because communications and orders can easily become confused and even countervailing.

The arguments for and against different organizational structures, particularly for semi-submersible rigs, have not been settled. Many strongly support a marine structure with a captain in overall authority at all times while others argue that while a drill rig is positioned, little navigational skill is required, drilling skills are paramount, and individuals with drilling skills should be in command.

We simply believe that whether an individual with captain's papers or an individual with predominantly drilling skills is in charge that effective leadership and a unified command structure is only possible if that individual has sufficient knowledge of both drilling and marine operations to command effectively. However, it is clear that the hostile North Atlantic requires specialized marine skills to ensure safe operations. Minimum standards for trained marine crew content must be specified.

A unified structure is difficult to achieve, because individuals trained in both marine and drilling operations to a sufficient degree, do not exist in sufficient supply. Compromise organizations will therefore be required until training programs have

developed the required skill base.

4. Command Structure Documentation Could be Improved

In the course of carrying out the project, we have examined the emergency response plans from many different operators and contractors. Generally, organizational responsibilities are identified with reasonable clarity. However, we note a number of areas where documentation could be improved.

- The communication lines which are indicated in several emergency response plans are highly complex, and radiate in all directions. They assume that the rig commander or his designate, has sufficient time to communicate with a wide variety of people including those who will not supply aid directly, rather than having to deal with the operational realities of the emergency at hand.

  Documentation must recognize that information flow must be centralized for effective decision making and that the rig commander's prime focus must be dealing with the operational realities of the emergency situation on-board the rig.

- We are told that some organization charts, which state that the captain is in command at all times, may over-emphasize the captain's responsibilities. The senior drilling person is frequently in overall command in actual practice in spite of documentation to the contrary. It would be preferable if emergency response plans would recognize this fact and clearly state the conditions when command is to change hands from one individual to another.

- Most emergency response plans do not clearly identify back-ups for key positions and who is to take over command if the rig

commander is incapacitated.

- About half of the emergency response plans we reviewed show organization charts with a confusing mixture of solid and dotted line relationships. Few organization charts indicate whether a dotted line constitutes an advisory responsibility, whether functional guidance is to be provided and if so what, or whether the individual in certain areas or functions is in command. Furthermore, some charts show more than one supervisory individual functionally responsible for the same area. In the above examples the charts do not specify what is meant. If organization charts and command structure and communication diagrams are to be effective they must be easily understood by all on board and must be kept as simple as possible.

Industry has had to develop and design command structures to deal with situations where both marine and drilling skills are essential. The operational nature of drilling rigs is such that the predominant skill requirements may change depending on whether a drill rig is in motion, whether it is positioned and drilling, or whether a marine or drilling emergency is being faced. Further, there is still a lack of individuals who are fully qualified in both marine and drilling skills. These factors have made it difficult for industry to develop strong unified command structures to deal with all possible situations.

C. COMMAND STRUCTURES SHOULD MOVE TO SUCCESSIVE ALERT STAGES

The triggering of an alert can be an effective way of preparing the command structure for action. However, the alert conditions must be clearly specified and the action to be taken in preparing the command structure for action clearly designated.

We have noted that roughly a third of the Operators' response plans

described alert conditions. For example:

- Different danger zones are noted for icebergs which depend on the distance of the iceberg from the rig and the direction of movement. The plans indicate the actions to be taken by the command structure in each of these instances.

- If there is a potential well control problem of a certain severity or probability, all personnel not directly active are to be mustered to life boat stations.

- Alert conditions exist for potential helicopter losses. For example, if a helicopter is more than fifteen minutes overdue it must be reported and search action is instigated.

- The new COGLA Drilling Guidelines provide alert conditions for heavy weather and indicate the actions which are to be taken. These guidelines include wind speed and wave height limits and are now been included in many of the response and contingency plans. These regulations, while called Winter Drilling Guidelines, apply on a year round basis.

While Operators are in the process of refining their response plans, our evaluation of command structure effectiveness would indicate that there are opportunities for further alert planning to be instituted. For example:

- Ensure that plans indicate what conditions will trigger an alert condition in shore-based operations support centres.

- Define the heavy weather conditions which will trigger an on-board alert. Procedures on anchored rigs, for example, do cite conditions for cable tension, heave, and roll limits which should not be exceeded.

- In normal operating hours, that is between 8:00 a.m. and 5:00 p.m. Search and Rescue can be actioned within a 30 min. response time. In evening hours, a 2 hr. response time is indicated. Conditions which trigger an alert call to Search and Rescue to put them on active standby have not existed. Recently DND Search and Rescue instituted an advanced alert procedure where crews will be scrambled and aircraft and boats put on notice to move closer to the scene of a potential emergency. The conditions which warrant putting Search and Rescue on alert, need to be clearly spelled out in the industry's contingency and response plans. Similar comments apply to the Coast Guard.

Additional work in identifying alert conditions and in developing procedures to move command structures to successive alert conditions can therefore be implemented.

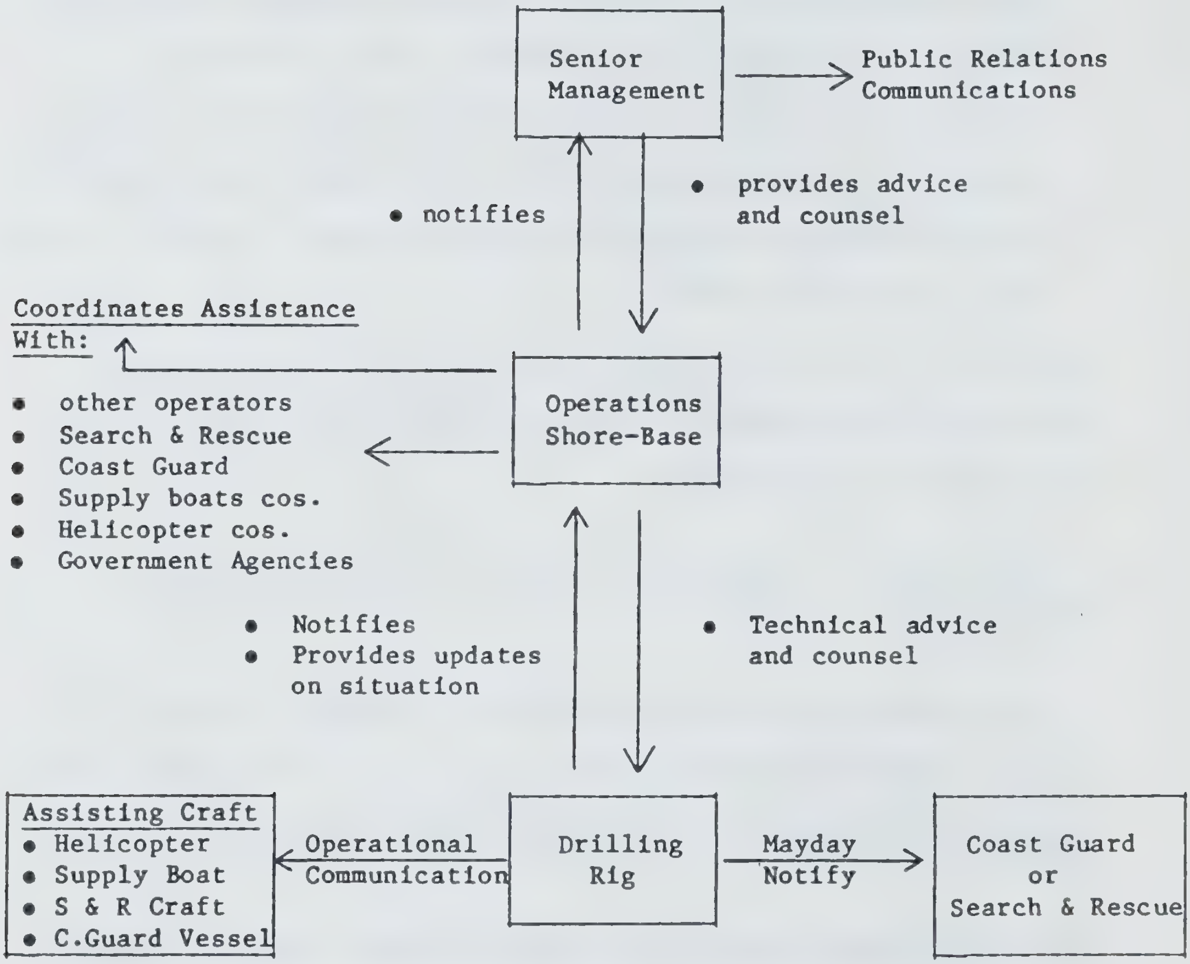
D. A STRONG SENSE OF ORGANIZATIONAL UNITY AND TEAMWORK ENHANCES EFFECTIVENESS

A strong sense of organizational unity and teamwork can foster effective emergency response action because all elements work together toward a common purpose. This is particularly true if the organizational unity has a strong dedication to safety.

The organizational cohesiveness, which fosters a unity of command, cannot be legislated. It can only be built up over a considerable period of time by strong leadership amongst individuals who have gained a respect for each other and for each other's skills, and who value teamwork.

The elements under which crews must live include: relatively constricted freedom of movement; potentially harsh working conditions; and, absence from home for at least three weeks at a time. It is therefore even more important to foster a close knit compatible

MODEL OF EMERGENCY COMMUNICATION PROCESS



working and living environment.

It is difficult for us to evaluate the number of drilling system command structures which have built up such teamwork. To do so, we would have to visit and spend considerable time with all of the operating units. However, it is our belief, based on the interviews we have conducted, that many offshore organizations exhibit these characteristics.

Because of the requirements for effective teamwork and because it takes a long period of time and team building processes even amongst experienced crew members, attempts to increase the Canadian content of crew members in offshore drilling must move at a controlled pace. It must be part of a designed program and training programs must be enhanced to allow for the effective assimilation of new crew members. Any wholesale, rapid changes of team members will severely affect the commitment of the crew to each other, to the safety values which have been built up over a long period of time, and to the coordination of efforts between elements of the crew with different skill backgrounds. The ratio of experienced to new crew members should be very high to ensure that the values of teamwork, safety, and unity can be assimilated by new crew members.

E. EFFECTIVE COMMUNICATION PROCESSES ARE REQUIRED

During emergency conditions it is essential that communication processes be kept as simple as possible. The rig should communicate directly on operational matters with the elements in the command system who are actually supplying aid, and that the operations support base must act as a command centre to support the rig manager by coordinating other elements in the command structure which might supply assistance. The model of the type of communication system we believe to be applicable is shown on the opposite page.

The model indicates that the drilling rig captain or his designate will notify Coast Guard or Search and Rescue of the emergency so that assistance can be supplied as quickly as possible. The direct notification by the captain is preferable to Search and Rescue or the Coast Guard being notified by the shore-based operations centre. This will ensure that the Coast Guard and/or Search and Rescue receive information about the actual or potential emergency without the distortion of one or more intermediary communication links. We understand that communications equipment is in the process of being improved so that Search and Rescue helicopters can communicate directly with rig and supply boat captains.

The drilling rig then will notify the operator's shore-based operations centre which should act as the "emergency command centre" during the entire emergency situation.

During the emergency, the drilling rig captain (or his designate) should also communicate directly with helicopter, supply boat, Coast Guard, or Search and Rescue pilots or captains of craft who are able to supply aid. These communications should deal with the operational issues involved in, for example, landing a helicopter on the rig, approach of supply boats to receive crew members, etc.

The Operator's shore-base in acting as the emergency command centre, and should support the rig commander by communicating technical assistance and advice to the rig, and by coordinating assistance from other elements in the network including other Operators, supply boat companies, helicopter companies, and government agencies. The Operator's shore-base command centre will have more time to coordinate such assistance than will the rig commander who must deal with the operational realities of the emergency situation on board the rig.

All communication processes should be centered in the "Emergency Command Centre" at the operator's shore-based support centre. This

ensures that complete information is available in one spot and decisions can be made with full information. If possible the Contractor's representative should also be present in the command centre. If communication processes are not so centralized then different individuals in the command structure will undoubtedly obtain different perceptions of the situation on the rig and could take actions which are inappropriate to the actual situation. Communication messages could tend to become confused and actions will not be well coordinated. The only communication processes which should be handled outside the Operator's command centre are communications with the press, which should remain the responsibility of senior management.

Most, if not all, Operators recognize the importance of the communication processes in ensuring an effective emergency response, and are working hard to ensure that these processes become more effective. Common deficiencies which we have noted in several of the emergency response plans we reviewed would include the following:

- In many cases communication patterns for the rig commander were overly complex and impractical. Some plans even specified that the rig commander was to notify government authorities such as COGLA and the Newfoundland Petroleum Directorate concerning the situation. It is possible that the drilling rig commander only has time for one or two calls if the emergency is at hand and these should be either to Coast Guard and/or Search and Rescue or if possible, to the shore-based operations command centre. Communication must be direct and to those who can best provide assistance.

- Several emergency response plans designated that the operations shore-base would communicate directly with the helicopter pilot or supply boat captain concerning operational rescue issues as opposed to these communications coming directly from the rig captain to the

pilot or captain supplying aid. It is essential that communications concerning operational matters be as direct as possible and flow directly from the unit in need of aid to the element carrying out the rescue operation.

- The most serious weakness noted in several plans concerns the long lines of communication from the operator's shore-base command centre through the management heirarchy of the operator's organization. In many cases, the operator's senior management team at various levels got involved to notify various government authorities, other operators, and even Search and Rescue. It is essential that all such communications be centred in an "Emergency Command Centre" so that the various authorities and elements in the broader command structure receive the same message. All decision making should take place in consultation with and through the Command Centre.

- In several emergency response plans, communications from the rig are not centralized through the Command Centre. Cases were noted where:

  - the oil company representative on board notifies individuals other than the Emergency Command Centre Officer, and

  - contractor personnel on board the rig notify the shore-based contractor's operations centre, rather than the "Emergency Command Centre Officer",

  - on board drilling personnel communicate with other personnel such as the onshore drilling superintendent rather than communicating through the "Emergency Command Centre Officer".

There is a tendency in the emergency response plans to try to cover every possible eventuality and to indicate all the communications

which should take place. This results, in some instances, in a complex pattern of communication which is not easily understood. It is important that the documentation of communication patterns be kept simple and straight forward, and indicate the general types of communication and role which is to be assumed by various elements in the communication network. This will facilitate communication responsibilities being easily understood by all persons on the rig.

F. EFFECTIVE PROCEDURES TO COORDINATE THE EFFORTS OF ALL ELEMENTS IN MULTI-OPERATOR AREAS

In multi-operator areas the exploitation of the full potential for supplying aid to a rig in emergency conditions requires the development of effective procedures and communication patterns, particularly as the various elements which make up the network are not under the control of a single contractor or operator.

Prior to the fall of 1983, Operators on the east coast had an understanding that, if a call for assistance was received in an emergency situation, assistance would be supplied by the operator receiving the request. However, this mutual aid pact did not document the procedures required to maximize the effectiveness of such assistance.

In the fall of 1983 the industry formally documented a Multi-Operator Alert Response Plan for all operators active off Newfoundland and the Scotian Shelf. This alert response plan is similar in nature to the pact which exists in the North Sea - the North Sea Sector Club. The joint operator alert response plan encompasses the following elements:

- A flight-following tracking system which provides a common facility for tracking all helicopter flights. This, not only provides a faster response for the provision of assistance to downed

helicopters, but also a central facility which is fully knowledgeable concerning the positions of all helicopters at any time. This centralized knowledge can be extremely useful if helicopter rescue for a rig in distress is required. As part of the flight following facility, the operators will maintain a designated helicopter which is available and can be commanded for search and rescue duties in case of emergency.

- A common iceberg tracking and weather reporting system is to be maintained.

- The alert plan specifies the conditions which should trigger a multi-operator alert and designates facilities and equipment which may be tasked in an emergency situation.

The development of this multi-operator alert response plan goes a long way to providing the coordination which is required between the various elements of the "broader drilling system" which might be able to provide assistance.

It is most important that all supply boat companies, helicopter companies and governmental agencies be fully aware of the plan. During our interviews in January, 1984 there were still some agencies in the area which had not become fully aware of the plan.

Additionally, it is important that the multi-operator alert response plan be executed through the "Emergency Command Centre" of the Operator which is experiencing the apprehended or actual emergency situation. This can be best carried out if the senior representative of the operator experiencing the emergency, can be physically located at the Emergency Command Centre.

The procedures which have been instituted, in our view, can provide a response which makes maximum use of the combined resources which are

available on a coordinated basis. We have a high regard for these actions.

G. EXERCISE OF THE COMMAND STRUCTURE

Exercise of all elements of the command structure is required in order to ensure adequate training and coordination of the various elements in the drilling system which might supply aid in time of an emergency.

Exercises which are conducted on board the rig such as man overboard, life boat drills, evacuation drills, blow out prevention drills and fire drills are generally well executed and at a frequency which ensures that all personnel are familiar with their duties. Industry sources indicated that it would be useful to carry out a greater number of these drills on a surprise basis to simulate actual conditions. It was suggested for example, that crew should be notified in advance that there would be a drill occurring sometime between the hours of say, 4:00 a.m. and 10:00 a.m., and that crew members not be given additional advance warning of the actual time of the drill activity. Other officials believe that surprise drills without advance warning would be <u>more</u> effective. A frequency of four times per year was suggested. However, rig personnel would have to agree to this approach.

Additionally, almost all operators/contractors carried out drills which involved the helicopter and supply boat companies which serve the rig in question. Such drills were designed to ensure that communications equipment was effective, that operating procedures worked, and that helicopter and supply boat captains were fully familiar with the particular requirements of the drilling rig.

Few Operators follow the practice of having crew members who are not involved in the safety exercise, act as observers to record areas for improvement. Additionally formal debriefing sessions following drills

are not regularly carried out. Such reports of drill effectiveness would assist in identifying areas for improvement and enhanced performance.

Few Operators carry out actual evacuation drills where life boats are lowered to the water with people in them. Such drills might be useful but they also entail some degree of risk both to the people participating and to the equipment involved. It was concluded after discussion with several knowledgeable individuals in the industry that such drills probably entail more risk than is warranted by the benefits to be gained. If this is so, additional work should be carried out to improve equipment and systems to the point where such drills can be carried out safely.

One contractor whom we interviewed had recently carried out a drill which tested the adequacy of back-up personnel on the rig. The drill involved the assumption that the captain was unable to function and assume overall command. The exercise demonstrated that a greater training of back-up resources in emergency procedures was required. In view of the previous findings concerning the significant differences in experience level between the senior and back-up resources, such drills would appear to be essential.

A number of exercises have been conducted to test the response readiness and systems of the broader command structure.

- Recently, on January 12 and 13 a paper exercise was carried out in Newfoundland. The scenario was an impending alert situation involving a medical evacuation. This training exercise was operator instigated and involved the Newfoundland-based Operators including Husky/Bow Valley, Mobil, PetroCanada and the Newfoundland Petroleum Directorate. The exercise, carried out over a two day period, was reported as being very realistic and those participating were required to liaise with regulatory bodies.

Those participating found the exercise beneficial and a full debriefing is underway.

- On October 7, 1983 an exercise was carried out involving the Zapata Scotian, Search and Rescue, and the Rescue Coordination Centre. This exercise involved a simulated explosion with injuries, the notification of Search and Rescue, and the activation of a helicopter and Buffalo aircraft. Search and Rescue personnel were brought to the rig in order to familiarize themselves with it. Earlier, in the spring of the same year, a similar exercise involving Shell Oil and the SEDCO 709 was carried out.

Such exercises have pointed out areas for better coordination with Search and Rescue and a number of these have been implemented including:

- 300 gallons of aviation fuel will be now maintained on rigs at all times for refuelling helicopters;

- Search and Rescue will now use Operator flight routes in order to facilitate easier coordination from the vessel. Search and Rescue will now get updated flight routes.

- Industry has investigated the requirements to upgrade Sable Island as an emergency base and is now in the process of implementing these improvements.

Such exercises can be extremely valuable. Search and Rescue and the Coast Guard must carry out manouevers, in any case, to make sure that their own internal systems procedures and equipment are functional and that their manpower is fully trained. However, there is good case to be made for carrying out a number of training exercises for Search and Rescue and the Coast Guard in conjunction with operators and rig contractors to ensure the government agencies are sufficiently

conversant with rig operations to effectively provide aid. We believe that such exercises should be conducted at least once a year for each rig that is operating. The frequency needed requires further discussion and is a function of the amount of training required and staff turnover.

H. DECISION MAKING MUST BE CLOSE TO THE SCENE OF THE ACTION

As stated earlier, critical decisions in an emergency situation must be made by the onboard commander who is close to the scene and has the best knowledge of the situation at hand. Since drilling rigs are located at a considerable distance from their shore-based support centres, it is not possible for on-board emergency operations to be directed effectively from the shore. If the rig is incapacitated, then decisions should be made by the designated "on-scene commander".

Some emergency response manuals imply that a number of key decisions in an emergency will be made by senior shore-based personnel. Interviews with knowledgeable drilling contractor personnel indicated that the actual amount of authority vested in drilling rig personnel varies considerably from operator to operator. Oil company personnel who were interviewed were unanimous in their belief that **drilling operations must be run from the rig, not from the shore-based operations centre, and that shore based personnel must act largely in an advisory, coordination and support role to the rig commander during apprehended and/or rig emergency situations. There is a requirement for emergency response plans to reflect this value system and belief.**

Operators and drilling contractors have generally been safety conscious and have been endeavouring to install personnel and procedures to make drilling operations as safe as possible. Recently, it has become

recognized that command structure effectiveness is an important element of the safety and emergency response program. Because of the rapid growth of the Canadian East Coast Offshore Drilling Industry, the structuring of the broader command organization has been in a rapid state of evolution. Additionally, because of world wide shortages of marine personnel qualified to manage drilling rigs, Operators have been hard pressed to staff their operations with the fully trained senior and back-up resources that they would wish to have. **We view the staffing and training of qualified resources as the most critical element in improving command structure effectiveness.**

Rapid progress is being made in these areas by the Canadian industry and we discuss in the next section of the report our recommendations on the further actions which are required.

VIII. RECOMMENDATIONS FOR IMPROVED COMMAND STRUCTURE EFFECTIVENESS

This section presents our conclusions on the opportunities to enhance command structure effectiveness.

A. THE SUPPLY OF TRAINED PEOPLE SHOULD BE ENHANCED

A number of actions might be taken to enhance the training for key drill rig crew positions in order to expand the number of trained individuals available to the industry. These include the following:

- To establish offshore drilling as a subset or specialty section of Canadian marine training with specific theoretical and practical training related to drill ships and semi-submersible drill rigs.

  Industry has already commenced discussions with the Coast Guard to see if drilling personnel can be trained in marine operations aboard Coast Guard vessels and if Coast Guard captains can be trained aboard drilling rigs in drilling operations. This type of

interchange would assist in improving the skills available to the industry. In addition, it would greatly enhance the Canadian Coast Guard understanding of rig operations and design principles. The Coast Guard is responsible for prescribing design and operating regulations.

Industry-wide standards and a certification process for rig commanders should be developed.

- To develop a training program and certification process for senior drilling staff, first mates, captains, and ballast control operators in ballast control operations.

- To establish an industry-wide training program for lifeboat captains. A Coxswain training program has been developed by the industry but has not gained formal recognition.

- To continue to train all personnel in marine survival skills utilizing the courses which have been developed.

In the United States we understand that the International Association of Drilling Contractors are actively working with the U.S. Coast Guard to define qualifications, standards, and training and certification programs for key positions. This same type of approach would likely be applicable to Canada. Such standards, training programs and certification processes which are developed in Canada should be compatible with those in other countries if this is possible.

B. EXISTING REGULATIONS SHOULD BE MADE INDUSTRY SPECIFIC

Both the Canada Shipping Act and the Coast Guard regulations need to be updated to deal with the specific requirements of the drilling industry. Industry input should be sought during the development of qualifications and certification programs to ensure that updated

regulations are realistic.

C. DEVELOP STANDARDS FOR UNITY OF COMMAND

As discussed previously, command structures for jack-ups, dynamically positioned drill ships, and some variations of the American and Norwegian models for semi-submersibles in theory, represent a strong unified command structure on board the rig. However, other models of command structure where the ultimate command is shared or where command changes from the marine element to the drilling element and vice versa are not as strongly unified.

It is our belief that wherever possible there should be one individual in ultimate command of a drill rig operation at all times. Shared responsibility for overall command requires a strongly cooperative relationship between the captain and senior drilling individuals to be effective and even then it is possible for a lack of coordination and for confusion to result, particularly in an emergency situation. Additionally, it is possible that one of the two individuals is more dominant than the other in terms of personality and therefore effectively commands at all times, possibly in situations for which his skills are not completely suited.

However, until there is agreement on the qualifications, and standards required for semi-submersible and drill ship rig commander positions, and until certification programs are developed and the supply of qualified rig commanders is adequate, command structures which are not completely unified will continue to exist. Further, it is likely to require several years of time to train and develop the required supply of qualified rig commanders, particularly if Canadian content requirements are maintained.

In the interim, and where fully qualified individuals in both drilling and marine operations do not exist, we would conclude that the

organization for drill ships and semi-submersible rigs formally recognize command as being under one individual. Command structure documentation should recognize clearly the aspects of command which will be delegated by that individual to others in the chain of command. Such documentation should also recognize limitations to the delegation of authority so described. For a command structure with shared responsibilities, to work we would recommend the following:

- If the captain is named as overall commander the responsibilities to be delegated to the senior drilling individual should be clearly specified. It may be that the senior drilling person commands substantial portions of the daily operations when the vessel/semi-submersible is stationary and drilling.

- It is important that limitations to this authority be clearly spelled out. It is also important that the captain retain substantial responsibilities. The captain should retain responsibility for the overall safety of the rig and safety drills, and be seen as the ultimate "safety commander". It is important that the command structure for normal operations support the structure which will be required in emergency situations. It is therefore important, even though the captain may have delegated substantial responsibilities while drilling operations are being carried out, that he remain active in terms of coordinating the overall safety program, supervising support functions such as maintenance, and in taking command to conduct emergency drills. In this way he will be seen as the ultimate "safety commander" and authority in marine and overall rig safety matters.

- That emergency response plans indicate clearly the alert conditions which trigger the assumption of overall command by the captain. It must be further understood that the captain may in his judgment re-assume overall command for conditions which are less severe than the alert conditions specified but that in no case will he not

re-assume command when minimum alert conditions are experienced.

Guidelines for the development of clear organization charts should be developed by industry for different command structures. The adoption of common documentation practices and methods of showing commanding lines of authority, functional relationships, and advisory relationships between elements in the drilling system would be beneficial to a uniform understanding of emergency response plan and command structure documentation.

D. COMMAND STRUCTURE ALERT STAGE DOCUMENTATION SHOULD BE FURTHER DEVELOPED

Further work should be carried out in identifying the specific conditions which trigger alert stages, and in defining the readiness activities to be undertaken at each stage by the command structure.

- Operator/contractor emergency response plans should describe the specific conditions which will trigger an alert condition in the shore-based operations support.

- Operator/contractor emergency response plans should indicate the minimum conditions which will trigger a call from the rig to put Search and Rescue on alert.

- An understanding by all elements in the system of the joint Operator's alert plan needs to be assured.

Alert conditions for each of the five emergency types should be specified in Operator/Contractor contingency plans. Preferably, these alert stages should be the same throughout the industry. Appropriate actions for readying various elements of the command structure throughout the drilling system to deal with the potential emergency must be clearly specified in all contingency plans.

E. DRILLING UNIT TEAMWORK AND UNITY SHOULD BE ENHANCED

As described previously a strong sense of organizational unity and teamwork is essential during emergency conditions. Such organizational teamwork and unity is doubly important in those organizations where ultimate command authority is shared or command shifts from the marine to the drilling element or vice versa. A number of actions might be undertaken to enhance such unity and teamwork including:

- Leadership and interpersonal skills training should be a requirement in the certification programs for senior rig positions.

- Specific training programs for senior marine and drilling personnel which foster an understanding of the technology, attitudes, and value systems inherent in the operation of the other element should be developed. Shore-based operations people should spend time on the rig and vice versa.

- A number of Operators have found that a weekly face-to-face operations meeting which includes the Operator, rig contractor, supply boat Operator, and helicopter Operator is an extremely valuable method of fostering enhanced understanding and teamwork.

- Government Canadianization efforts must recognize the length of time required to build up teamwork and unity and the importance of such unity to safety. Attempts to increase Canadian content must therefore be implemented very slowly and carefully. New crew members can only be introduced, even at the junior levels, at a designed rate. Such rates need to be agreed between industry and government. We would see however, the maintenance of fully trained to new trained staff at a minimum of 10 to 1 ratio at any point in time. The speed at which assimilation can take place is also very

dependent on the training programs which are instituted.

F. COMMUNICATION PROCESSES SHOULD BE STANDARDIZED

Although communications will differ from one organization to another the basic communication patterns in most cases should remain the same.

- Drill drig commander notifies Search and Rescue or the Coast Guard and the Operations shore-base of an alert condition or emergency.

- Drill rig commander or on-scene commander communicates directly with the helicopter, or vessel supplying aid

- All communications are centralized through the Operator's emergency command centre.

In addition to simplifying communication patterns as specified above, it would be most useful if a common set of alert codes is adopted. These codes would signify the degree of severity of the apprehended or actual emergency and would trigger a preplanned response on behalf of the elements in the drilling system which are in a position to supply assistance. It is important that all elements in the drilling system **have a common understanding of alert messages and appropriate responses.**

G. EXERCISE OF THE WIDER COMMAND STRUCTURE SHOULD BE MORE FREQUENTLY UNDERTAKEN

Industry sources indicated that safety drills on board most rigs provide adequate training for individuals in carrying out their normal duties in an emergency situation. However, these exercises should be carried out periodically in a way which will test and assure that back-ups for key positions also understand how to carry out the duties of their superiors should they be injured or otherwise

unavailable during an emergency. This requirement is particularly important considering the earlier findings that the overall level of training and experience amongst those in back-up positions is significantly less than that of those in charge.

A number of exercises involving Search and Rescue, the Coast Guard, and other government regulatory agencies have been carried out. However, it is particularly important to test the procedures, and communication systems of the broader command structure as close logistical support is required amongst elements which are under the command of independent organizational units which have different internal procedures, value systems, and methods of operating. In this regard we suggest the following:

- That industry and government evaluate the applicability of carrying out additional paper exercises similar to the one carried out on January 12 and 13, 1984 which involved the Newfoundland-based Operators and the Newfoundland Petroleum Directorate.

- That simulated emergency exercises involving Search and Rescue, the Rescue Coordination Centre, and Coast Guard, be carried out by each rig at least once per year in order to test systems and enhance the knowledge of these governmental agencies in drilling operations and emergency conditions.

- That several different exercises aimed at testing the effectiveness of the joint Operator alert response plan be carried out on an agreed frequency basis. These exercises would be designed to test inter-operator communication systems, emergency response readiness of designated helicopters, emergency response readiness of other Operator supply boats, as well as other elements of the system such as the functioning of Sable Island as an emergency base.

The implementation of regular drills at all levels in the command

structure is a key element in monitoring and assuring command structure preparedness. The appointment of crew members or others to act as independent observers to detect areas for improvement and the implementation of formal debriefing processes are key elements which need to be implemented to improve the effectiveness of all exercises and drills.

We have suggested in this section a number of areas where we think there is an opportunity to make additional improvements in command structure effectiveness. We believe the most critical area where substantial improvement is required is in the definition of agreed qualification requirements for key positions. This will require the development of industry-wide certification programs, and the implementation of substantial training programs to provide the industry with senior rig managers and back-ups who are trained to the extent necessary in both drilling and marine operations and technology. **Actions in other areas are important but the benefits of these actions will not be fully realized until a strong and comprehensive program is undertaken to upgrade the quality of manpower available to the industry.**

IX. CONCLUSION

Our investigation of command structure effectiveness indicates that much progress has already been realized in recognizing the importance of command structure effectiveness to the safety of the offshore drilling industry. Many improvements have already been implemented. We hope that this study contributes in providing insight which will stimulate further action to improve the safety in East Coast offshore drilling.

We wish to thank the many individuals from oil companies, drilling contractors, and others who participated in our interview program to provide information in a completely frank and open manner, and who contributed many extremely valuable insights and suggestions.

CURRIE, COOPERS & LYBRAND

David E. Smith

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Currie, Coopers
& Lybrand

STATEMENT OF WORK

INTRODUCTION

The Royal Commission on the Ocean Ranger Marine Disaster has been given comprehensive Terms of Reference which are divided into two parts.

Part One calls for an extensive investigation into the loss of the drill rig, Ocean Ranger. This inquiry has been underway since the Commission was jointly established in March 1982 by the governments of Canada and Newfoundland and Labrador.

Part Two of the Commission's Terms of Reference call for it to "inquire into, report upon, and make recommendations with respect to" both the marine and drilling aspects of practices and procedures in respect of Eastern Canadian Offshore drilling operations and to a number of specific matters relating to drilling units operating offhshore.

To address the Part Two Terms of Reference, the Commission is undertaking a study program the goal of which is to identify practical means of improving the safety of Eastern Canada Offshore drilling operations.

The study area is Eastern Canadian Offshore extending from the shoreline to the limits of jurisdictional claims. The area extends from the Canada-US boundary north to the limit of areas which will be serviced from East Coast ports and use marine drilling systems (approximately 75 N).

The subject of study is offshore exploration and delineation drilling operations, including service and supply (marine and air) activities.

The issue is human safety. Property safety will be considered to the extent it affects human safety. Environmental safety will be addressed by a State of the Art Review.

The Part Two Study Plan will include the following areas:

1. Environment

This study area will address the physical environment conditions within which offshore drilling operations take place. Emphasis will be placed on severe and limiting conditions and their detection or prediction.

2. Regulation

This study area will address the manner in which offshore drilling operations are controlled by rules, regulations, and guidelines and their relationship to safety. Emphasis will be on government control, but included will be industry control.

3. Design

This study area addresses the process of conception, design, construction, classification, and certification of structures and equipment used in

offshore drilling operations. It will include consideration of operational limitations and upkeep requirements.

4. Safety

This study area focuses on elements of offshore drilling operations directly related to establishment and maintenance of personnel safety. It includes the identification of levels of risk for various activities. It deals with workplace health and safety. In particular it will address systems to ensure survival and minimize injury resulting from unplanned events. Special focus will be given to systems of evacuation, survival and recovery, including self help as well as external assistance.

5. Training

To evaluate and, as appropriate, recommend improvements to operational marine and safety training for the Eastern Canadian offshore petroleum industry and related sectors.

STUDY OBJECTIVE

To assess critically, the normal and emergency command structure, and their functioning, of "drilling systems" in relation to Eastern Canada offshore exploratory drilling operations.

Definitions

"Drilling System" - refers to a drilling unit and the support facilities such as support vessels, transport helicopters, and shore bases assigned to that particular drilling unit.

Chain of Command - refers to the command structure and related responsibilities and authorities of various levels within the command structure.

Information Flowpaths - refers to the verbal and written flow of information within the command structure and between the command structure and external contacts.

SCOPE

The study will be concerned with the normal command structures of "drilling systems" and the emergency command structures for dealing with: a major fire on a drilling unit, the loss of a support craft (vessel or helicopter), the loss or disablement of a drilling unit, and the loss of well control. It will examine the influences of government regulations on command structures.

An evaluation of planned and actual emergency command structures will be made; and criteria will be developed for effective emergency command structures.

The emergency command structures currently planned in the Eastern Canada offshore will be evaluated to determine their effectiveness.

TASK DESCRIPTION

1. The contractor will compile a list of all "drilling systems" which have been used in the study area from 1975 to the present.

2. The normal command structure for each "drilling system" will be documented. This documentation will include the internal command structure within specific units of the "drilling system" as well as the normal command structure for the "drilling system" in its entirety.

This description will include the relationships within the command structure of all the groups involved in the "drilling system". These will include the oil company, drilling contractor, marine support, air support, and subcontractor personnel.

3. The normal command structures investigated will be grouped into a small number of like normal command structures which show the basic normal command structure for the "drilling system" in its entirety.

4. Government guidelines and regulations dealing with normal and emergency command structures will be described and evaluated.

5. Describe all incidents in the Eastern Canada offshore where the normal command structure has been converted to an emergency command structure. This will include all actual or apprehended circumstances involving a major fire on a drilling unit, the loss of a support vessel, the loss of a helicopter, the loss or disablement of a drilling unit, or the loss of well control.

6. The incidents where there has been a change from the normal command structure to the emergency command structure will be analysed. A comparison of the planned emergency command structure and its functioning and the actual emergency command structure which evolved and its functioning will be made.

Reasons for differences between the actual and planned emergency command structures and their functioning will be documented, and an assessment will be made as to their effects. The incident involving the loss of the Ocean Ranger will be excluded from this analysis.

7. An analysis of actual incidents which involved a major fire on a drilling unit, the loss of a support vessel, the loss of a helicopter, the loss of disablement of a drilling unit, and the loss of well control will be undertaken. A minimum of two examples of each type of incident will be examined; and if possible, the incidents will be from the Eastern Canada offshore region. If the data for the incident is not available from the Eastern Canada offshore, incidents which have occurred elsewhere will be analysed with preference being given to incidents which have occurred in the North Sea or in the USA.

The analysis will consist of a comparison of the planned emergency command structure and its functioning and the actual command structure which developed during the incident and its functioning.

Differences between the planned and actual structure and its functioning will be assessed and the reasons for these differences will be documented.

8. In the case where incidents from elsewhere in the world are analysed, the normal command structure for the "drilling system" will be documented; and the effects of government regulations on both the normal and emergency command structures will be assessed.

9. From the analysis of actual incidents, criteria will be developed for effective emergency command structures for each type of incident.

10. The planned emergency command structures for each type of incident which have been formulated for current Eastern Canada offshore drilling programs will be evaluated against the developed criteria, and an assessment will be made of their effectiveness.

11. The effects that the requirements of an effective emergency command structure may have on the normal command structure will be discussed.

REPORT REQUIREMENTS

Ten copies of the draft final report will be provided. A single camera-ready copy of the final report will be provided.

The report format, type size, and spacing will adhere to Commission guidelines for appendix documents.

RELEASE OF REPORT

It is a policy of the Commission that reports submitted to it will be released to the public. These reports will be identified as exercises funded by the Commission's viewpoint. The timing of the release of these reports will be at the discretion of the Commission.

APPENDIX II

INTERVIEW QUESTIONNAIRE

I. DRILLING CONTRACTORS

A. List the oil companies/drilling contractors you have provided drilling services for.

B. How do command structures get established? How are staffing arrangements determined to ensure qualified personnel in each position?

C. How have the command structures and reporting relationships differed with different oil companies/drilling contractors. (Include description of all actual command structures from 1975 - 83 that the drilling contractor has participated in.)

D. What is your command structure under the following 5 types of emergencies?

(a) fire on board
(b) loss of support craft
(c) loss of well control
(d) heavy seas (potential disaster)
(e) disablement of rig

E. Does the structure change under emergency situations?

- how?
- who decides and when?
- is full command exercised over all personnel on board or only over certain departments of marine elements?
- what is the degree of participation by drill system personnel in implementing: safety measures, counter disaster measures, evacuation control, etc.?

F. For each of the organizational arrangements described above:

1. What was the role of contractor personnel vs. oil company representative(s) on the rig, on shore, in local offices?

2. For each of the structures above, describe the organization structure with respect to your personnel.

- principal responsibilities of rig personnel
- authority of each and limitations to authority

3. How does this structure change depending on whether the rig is:

(a) In port
(b) undertow/in transit
(c) positioning
(d) positioned but not drilling
(e) drilling

4. Who is (are) second in command?

5. Does anyone on board have ultimate authority under normal conditions?

   - under each of the 5 emergencies
   - who has the ultimate authority to "abandon rig"? - is the decision based on the marine commander's judgement?

6. What are the pros and cons of these different organization structures in:

   - normal conditions
   - emergency conditions (for each of the 5 specified types of emergencies)

G. What are the interfaces in the command structures with:

   1. Drilling Contractors
   2. Coast Guard
   3. DND emergency rescue
   4. Helicopter Service
   5. Supply boat operators/captain
   6. Shore based contractors structure
   7. Exploration companies

   under normal and emergency conditions.

   Under each of the 5 types of emergencies, when does the authority on the rig change from marine to drilling personnel? Who decides? Are all personnel under his authority?

   - What are the strengths and weaknesses of these arrangements?

   - How could these arrangements be improved to deal with each of the 5 types of emergency?

H. What communication patterns and procedures are to be followed to deal with each of the 5 types of emergencies effectively and to make sure the person in authority has the necessary information to make the correct decisions. How does he communicate to implement decisions and how well does it work?

I. What documentation exists to describe the command structures just discussed:

   1. Description of contractor's responsibilities vs. others in the command structure.

   2. Job descriptions of contractor's key personnel.

   3. Contingency plans to deal with each of the 5 emergency types (portions which deal with command structure only).

   4. Descriptions of communication patterns that should exist under normal and emergency conditions.

5. Safety programs, procedures, safety & evacuation drills.

   Obtain copies of relevant portions of contractor's current documentation.

J. Please cite all potential, apprehended, or actual emergencies of the 5 types specified that you have been involved in.

   1. Who in the command structure first finds out about an impending or real emergency? How does he find out? To who does he report the information?

   2. How were they handled?

   3. Were these handled satisfactorily or not?

   4. Did these cause changes in the command structure, contingency plans, etc.? If so, please describe.

   5. Did you modify procedures/command structure after the emergency resulting from orders from "above" or acted on your own?

K. At onset of suspected or real emergency, what are the means of communication at your disposal?

   1. - with whom?
      - frequency of contact?
      - hours of operation?
      - efficiency/dependability/recommendations?

   2. Is an "Emergency Control Centre" set up where all departments are represented and work together or does each department operate from its normal control room or office?

   3. Do you use a system of coded degrees of alert: e.g., RED
      YELLOW
      GREEN

      and who determines the degree and authorizes its dessemination?

   4. Do you hold a practice at the onset of a suspected emergency?

L. How are these incidents documented; both the actual and also the apprehended incidents?

   - what regulations prescribe documentation of incidents?

   - who is responsible for documentation level of personnel; marine or drilling operators? Is command structure effectiveness documented?

   - what are the follow-up practices?

   - to whom are documents circulated?

M. Who is responsible for designing, training and monitoring on-rig safety programs and emergency procedures for

a) drilling operations b) marine?

1. What are the types of practice drills conducted? How frequently?

2. What regulations govern your command structure, safety programs and response practices for each of the 5 types of emergencies?

N. Do government regulations, as they now exist, help with respect to the establishment of an effective command structure? How might these be modified?

O. Do safety training and drills exercise the command structure and provide satisfactory data on its effectiveness? Do they exercise the knowledge of on-board personnel of their activities in an emergency satisfactorily?

P. Is it clear who is in charge of the use of various pieces of equipment in the event of an emergency, e.g.:

- personal safety equipment
- life boats, etc.?

1. Do personnel know of their location?

2. Who gives the command to break them out and under what circumstances?

3. Who is in charge of upgrading and training personnnel and generally administering this equipment to ensure it is functional and up-to-date?

Q. Does a Safety Board or council exist or is it a "one man responsibility" namely - the rig safety officer?

1. If board function, is there "workers" representation/spokesman?

2. Are rig and marine <u>engineer</u> officers part of Safety Board?

3. To whom does the Rig/Marine safety officer report under:

i) normal conditions
ii) predicted or developing emergency situations?

4. Are there Safety Officers for each department/function on board the rig? Describe relationship, if any, with Rig safety officer.

R. What changes are being implemented, or planned to the command structure, procedures, training or practice drills around personnel safety?

1. Are there any physical system changes?

2. How would these effect procedures, training, responsibilities, or even the command structure?

APPENDIX III

List of Individuals Interviewed

I. Oil Companies

Individual	Company & Position
Mr. D. Dane	Project Manager, Shell Canada Resources
Mr. R. Fodchuk	Logistics Manager, Shell Canada Resources
Mr. H. Rud	General Manager, Maritimes, Petro Canada
Mr. R. Blackburn	Area Manager, Mobil Oil (telephone interview)
Mr. D. Bewes	Legal Counsel, Mobil Oil
Mr. J. Mounteer	Chief Drilling Engineer, Mobil Oil
Mr. S. Johnston	Drilling Superintendent, Canterra (telephone interview)
Mr. N. Labreque	Safety Manager PetroCanada
Mr. W.P. Nicholls	Frontier Support Coordinator, Canterra
Mr. E. Bennett	Drilling Manager, Esso Resources
Mr. F. Bewer	Senior Safety & Training Coordinator, Esso Resources
Mr. R. Richardson	Manager Drilling, Chevron
Mr. E.H. Gaudet	Legal Counsel, Chevron
Mr. L. Prather	Drilling Manager, Husky Oil
Mr. M. Graham	Drilling Superintendent, Mobil
Mr. M. Woolridge	Area Manager, Loss Prevention & Control, Mobil

II. Drilling Contractors

Mr. R. Smith	Area Operations Manager, Bow Valley Offshore Drilling
Mr. G. Rennie	Operations Superintendent, Bow Valley Offshore Drilling
Mr. J. Plotnikoff	Administrative Superintendent Bow Valley Offshore Drilling
Mr. H. Popoff	Vice President, Bow Valley Offshore Drilling
Mr. H. Morton	Manager, John Shaw SONAT
Mr. V. Grief	Operations Manager, SEDCO
Mr. F. Williford	Assistant Vice President, Operations SEDCO
Mr. H.L. Zinkgras	Vice President, World Wide Equipment, SEDCO
Mr. G. Beard	Rig Superintendent, ZAPATA (by telephone only)
Mr. D. King	Vice President Operations, Canada ZAPATA (by telephone only)
Mr. R. Miller	Rig Superintendent, Rowan Cos.
Mr. K. Bjerke	Vice President Operations, SDS Drilling
Mr. D. Sonnier	Manager, Global Marine Drilling
Mr. E. Hastings	Area Sales & Contracts Manager Global Marine Drilling
Mr. H. Soerhen	Base Manager, St. Johns, Smedvig
Mr. C.F. Hammonds	Operations Managers, PN Drilling SA (documentation received, no interview conducted)

III. Supply Boat Operators

Mr. G. Curren	Manager, Crosby Offshore
Mr. H. Pritcher	Manager Operations, Balder Offshore

IV. Helicopter Companies

Mr. P. Williams	Manager Operations, Universal Helicopters
Mr. P. Looten	Chief Pilot, Universal Helicopters
Mr. G. Fowlow	Job Manager, Universal Helicopters

V. Government & Others

Mr. A. Cobb	Director General, COGLA, Newfoundland
Mr. B. Harvey	Engineer, COGLA, Newfoundland
Mr. W. Potter	Executive Director, COGLA, Halifax
Mr. T. Starr	Royal Commission Contact, COGLA, Ottawa
Mr. John Fitzgerald	Executive Director, Newfoundland Petroleum Directorate
Mr. G. Goss	Newfoundland Petroleum Directorate
Admiral Fulton	Chief Altantic Command Canadian Navy (now retired) Conducting study for the Royal Commission on Search & Rescue
Messrs. Stack I. Green C. Peddle	Conducting study with Admiral Fulton

Drilling Units 1975-1983

APPENDIX IV

East Coast

Location	Drilling Unit	Type	Contractor
Scotian Shelf	Sedco J	semi-sub	SEDCO
Bay of Fundy	Sedco J	semi-sub	SEDCO
Labrador Shelf	Pelican	drillship	Foramer
Labrador Shelf	Sedco 445	drillship	Shell Deep-water Drilling
N.E. Nfld. Shelf	Sedco J	semi-sub	SEDCO
Labrador Shelf	Havdrill	drillship	Nordic Offshore
Scotian Shelf	Sedco H	semi-sub	SEDCO
Labrador Shelf	Petrel	drillship	Foramer
Labrador Shelf	Zapata Ugland	semi-sub	Zapata Ugland Drilling Inc.
Scotian Shelf	Gulftide	jack-up	ODECO
Scotian Shelf	Ben Ocean Lancer	semi-sub	ODECO
N.E. Nfld. Shelf	Discoverer Seven Seas	drillship	Offshore Int. S.A.
Grand Banks	Sedco 709	semi-sub	Marine Drilling S.A.
Grand Banks	Glomar Atlantic	drillship	Global Marine Drilling
N.E. Nfld. Shelf	Sedco 707	semi-sub	S.E. Drilling Service
Grand Banks	Sedco 706	semi-sub	706 Drilling Co.
Gulf of St. Lawrence	Salenergy IV	jack-up	Salenergy Corp.
Labrador Shelf	Nedrill II	drillship	Nedrill (Nederlond) B.V.
Labrador Shelf	Glomar Atlantic	drillship	Global Marine Drilling
Labrador Shelf	Pelerin	drillship	Helmer Staubo
Scotian Shelf	Rowan Juneau	jack-up	Rowan Co's Inc.

Location	Drilling Unit	Type	Contractor
East Nfld. Basin	Zapata Ugland	semi-sub	Zapata Offshore Drilling Ltd.
Grand Banks	Ocean Ranger	semi	ODECO
Labrador Shelf	Pacnorse I	drillship	P.N. Drilling S.A.
Scotian Shelf	Bowdrill I	semi-sub	Bow Valley Offshore Expl. Inc
Scotian Shelf	Zapata Scotian	jack-up	Zapata Offshore Cda. Ltd.
Scotian Shelf	Vinland	semi-sub	SDS Drilling
Grand Banks	West Venture	semi-sub	Smedvig Drilling Co.
Scotian Shelf	John Shaw	semi-sub	Sonat Offshore Drilling Co.
Scotian Shelf	Sedco 709	semi-sub	SEDCO
Grand Banks	Zapata Ugland	semi-sub	Zapata Offshore
Scotian Shelf	Bowdrill 2	semi-sub	Bow Valley Offshore Expl. Inc
Grand Banks	John Shaw	semi-sub	Sonat Offshore Drilling Co.
Scotian Shelf	Glomar Labrador I	jack-up	Merican Offshore Drilling Services Ltd.
Grand Banks	Sedco 710	semi-sub	SEDCO
Gulf of St. Lawrence	Bowdrill 1	semi-sub	Bow Valley Offshore Expl. Inc

DESCRIPTION OF RESPONSIBILITIES OF COMMAND STRUCTURE POSITIONS & ORGANIZATIONS

I. RESPONSIBILITIES OF COMMON POSITIONS

This appendix illustrates the key responsibilities for positions common to most organizations in the drilling system. The purpose of separating these out is to eliminate redundant comments when describing the different drilling system command structures.

A. OPERATORS' PERSONNEL

1. Position: Operator's Representative on Rig

a) Overall Responsibility.

- Provides overall direction to the contractor's senior toolpusher (rig manager) on all matters pertaining to the drilling program and monitors progress and technical information.

- Reports regular and non-routine information on drilling program to drilling superintendent/manager on shore.

b) General Safety Responsibility

- Ensures on-site operator's safety guidelines and requirements are met.

- Monitors and participates in safety drills and exercises.

c) Emergency Responsibilities

- In all emergency situations the Operator's representative reports situation condition, forecasts and progress toward addressing conditions to shore base operations management;

- Where outside support is required, e.g. Coast Guard, S&R, R.C.M.P., may be requested by the Captain to notify these organizations; otherwise will request shore base to secure assistance from these organizations.

d) Loss of Main Support Craft

- Ensures Search and Rescue is notified.

- Reports emergency to on shore operator's superintendent/managers.

- Dispatches standby vessel & helicopter if appropriate.

- Maintain contact with vessel in distress (if possible).

If other than company vessel:

- Ensure Mayday has been received by R.C.C.

- Confer with own standby vessel and direct as appropriate.

- Maintain contact, if possible, with vessel distress.

e) Loss of Rig Stability

- If standby vessel not involved in stability problem, calls to alert vessel of apprehended or real emergency.
- Directs radio operator to call R.C.C. if in state of emergency.
- Requests assistance from helicopter company.
- Calls shore base E.C.O. to advise of emergency status and response plan.
- Confers with senior toolpusher regarding action required to shut in hole and disconnect if required.
- Initiates his responsibilities for evacuation under the direction of the Captain.

2. <u>Position: Drilling Superintendent/Manager</u>

a) Overall Responsibility

- Contributes toward ensuring that all Contractors meet the Operator's operating standards and contractual arrangements.
- Directs the Operator's representative (drilling foreman) on the rig to ensure that the drilling program is being achieved.
- Monitor's drilling results and consults with Drilling Manager/Area Manager and drilling foreman along with other technical specialists.

b) General Safety Responsibility

- Ensures all contractors meet the company's safety and health standards and full requirements of COGLA and other regulatory bodies.
- Contributes to the development and administration of safety policy, procedures and drills.
- Monitors safety performance.
- Assists in administering safety exercises.
- Usually acts as Emergency Control Officer.

c) Emergency Responsibilities

- Receives emergency alert from on-rig drilling foreman via radio operator.

- Confirms emergency conditions through discussion with drilling foreman.

- Advises helicopter contractor to make ready and/or proceed to emergency site.

- Maintains contact with rig personnel to receive update on emergency situation.

- Contact CCG/S&R (if not already done by rig personnel).

- Assures C.O.G.L.A. and Nfld. Petroleum Directorate informed.

- Arranges for additional charter support or aid from other operators as required.

- Directs emergency activities and terminates them at the appropriate time.

3. Position: Area Manager

a) Overall Responsibility

- Contributes toward ensuring drilling program is developed, and effectively communicated to subordinates and drilling contractor.

- Ensures contractor and charter arrangements are secured and that they meet the company's policies, standards of operation and requirements.

- Acts as senior liaison officer with government departments, agencies and other bodies directly or indirectly related to the operating and safety aspects of the drilling program.

- Keeps company senior executives advised of drilling program results.

b) General Safety Responsibility

- Ensures appropriate safety policies, procedures and programs, including contingency plans are developed, promulgated and understood, and that they meet C.O.G.L.A., CCG, Canada Shipping Act, Nfld. Petroleum Directorate and other agencies and government departments requirements.

- Ensures contractors' safety policies, procedures and programs meet company standards.

- Oversees periodic exercises.

c) Emergency Responsibilities

- Meets with other staff in emergency control room, if required.
- May act as E.C.O. (See Drilling Supt/Mgr).
- Informs head office senior management of emergency and response (planned or in effect).
- Informs provincial department(s), C.O.G.L.A, and N.P.D.
- May request support from other operators.
- Informs legal council.
- Informs Public Affairs Officer.
- Ensures appropriate reporting is completed.

B. CONTRACTOR'S PERSONNEL (SHORE BASE)

1. Semi Submersible: Operations Superintendent

a) Overall Responsibility

- Provides direction to all contractor's crew on board from the shore base.
- Ensures the operations of the rig meet the company's standards as well as those of the operator.
- Ensures material and equipment are made available to the rig and liaises with the operator's shore base personnel to arrange for either helicopter or supply vessel dispatching.
- Ensures the senior managers including the captain and the senior toolpusher on board are meeting their mutual and respective responsibilities and that the harmonious working environment is maintained on the rig.

b) General Safety Responsibilitiy

- Ensures the contractor's safety procedures are documented, in cooperation with other company personnel, and are well understood and in place on board the rig.
- Monitors safety system statistics and prescribes a corrective action when needed.
- Monitors the results of safety drills, assists in directing these drills on occassion, and monitors results; prescribes corrective action where required.

- Coordinates safety activity with the operator's managers as well as any other agencies such as the Canadian Coast Guard COGLA, etc.

c) Emergency Responsibilities

- Will usually act as the contractors emergency control officer.

- In the event of an emergency contacts operator's ECO mnd arranges meeting in operator's emergency control room where necessary.

- Advises contractor's area manager of emergency and calls other staff in as needed.

- Cooperates with operator's personnel in maintaining contact with the rig and other support vessels and assist in developing immediate action plans and advice to the rig.

2. Semi Submersible: Area Manager

a) Overall Responsibility

- Participates in arranging and developing a drilling contract with the operator.

- Ensures that the drilling operations and the operations of the rig as a whole meet the company's standards as well as those of the operator.

- Provides overall direction to the staffing, managing and maintenance of the rig.

- Arranges with the operator for commencement of drilling and/or moving of the rig.

- Maintains close contact with senior executives on the drilling program and the operation of the rig.

b) General Safety Responsibility

- Directs the activities of preparing response plans in accordance with government regulations and those requirements of the operator.

- Ensures through his staff that response plans safety procedures and drills are well understood and are in place.

- Monitors the safety statistics and ensures that his operations superintendant prescribes appropriate corrective action when neccessary.

- Coordinates with the operator, COGLA, and other government agencies in multi-operator or multi-support service drill exercises.

c) Emergency Responsibilities

- Ensures his own staff are in place to participate and coordinate with the operator in emergency control procedures.
- Advises head office staff of the emergency situation and its status and future action.
- Advises the RCMP and families of personnel concerned in the event of death or injury.
- Cooperates with the emergency control team in developing short term response plans and immediate courses of action as well as advice to the rig.
- Ensures appropriate reports are prepared and disseminated to the appropriate organizations and agencies.
- May be requested to advise COGLA, the Newfoundland Petroleum Directorate or other individuals and organizations as requested by the emergency control officer.

3. Jack Up: Rig Manager/Superintendent

a) Overall Responsibility

- Provides overall management and direction of rig activities.
- Ensures operations meet condition of contract and standards of the Operator.
- Provides overall direction for the supplying and maintenance of the rig.
- Keeps own head office management advised of drilling operation status and incidents.
- Since this person often is a certified rig mover, may be responsible for moving rig.
- Maintains liaison with Operator's local management team.
- Ensures properly qualified staff are secured for operations.

b) General Safety

- Ensures safety procedures and training are established and in place, usually in concert with head office personnel.

- Monitors safety performance and drills; takes corrective action if necessary.

- Ensures company's procedures at least meet standards of the operator.

c) Emergency Responsibilities

- Receives notification of emergency and organizes own shore base personnel.

- Contacts shore base oil company manager(s), and if required, meets in Operator's emergency control office.

- Establishes contact and confers with rig superintendent; provides input and advice.

- In co-operation with oil company, determines the rig's need for support from other rigs and/or operators, and assists in determining advised course of action if time permits.

- Establishes and maintains contact with other agencies such as C.O.G.L.A., if appropriate.

4. Drill Ship: Operations Superintendent/Manager

a) Overall Responsibility

- Provides overall management and direction of the rig activities.

- Ensures properly qualified staff for the drill ship operations.

- Ensures that the operation of the drill ship meets not only the company's own standards but the terms of contract and the standards of the operator.

- Ensures also that the operation of the drill ship meets the appropriate regulations as prescribed by various government agencies.

- Ensures that the drill ship is properly supplied and maintained.

- Keeps own head office management apprised of the drilling operations status and any incidents that may have occurred.

- Liaises with the operator in terms of the drilling program commencement of drilling and/or movement of the drill ship to another location.

b) General Safety

- Ensures training of the crews and safety procedures are established and in place, usually in concert head office personnnel.

- Ensures also that the safety procedures, drills and exercises are in accordance with the company's own standards as well as those prescribed by the operator.

- Monitors safety performance and the results of drills: takes corrective action when and if necessary.

- Ensures generally, that the drilling operations meet the guidelines, standards and regulations as prescribed by various government agencies.

c) Emergency Responsibilities

- Upon notice of emergency contacts own staff to meet at the company's own office or probably in the operator's emergency control room.

- Ensures appropriate agencies such as C.O.G.L.A. and the coast guard have been notified of the emergency if required.

- Advises own head office management that an emergency is occuring and its status as well as future action plans.

- Confers with the rig captain or superintendent regarding the status of the emergency.

- In cooperation with the oil company determines the drill ship's needs for support vessels, Coast Guards/Search and Rescue, or the activation of the mutli-operator response plan.

- Establishes and maintains contact with other agencies such as C.O.G.L.A. if requested by the E.C.O.

- Ensures that a complete report of the incident is documented and transmitted to appropriate personnel in his own organization and other agencies.

II. COMMAND STRUCTURES FOR COMMON ORGANIZATIONS

A. SUPPLY BOAT COMPANIES

1. Position: Operations Manager (shore-based)

a) Overall Responsibility

- assigns ships to specific duties;
- receives and cooperates in responding to messages from the ship's master:
- manages charter arrangements with Operators

b) General Safety Responsibility

- ensures safety procedures and emergency response plans in place and understood by masters and crews.
- ensures the above and the operator's contingency plan are read and understood by ships' masters.
- oversees acquisition, maintenance and training in use of required safety and rescue equipment.

c) Emergency Responsibilities

Includes: man overboard, survivors from rig or helicopter crash and rig evacuation:

- receives notice of emergency from master;
- provides land based support as required;
- participates, to extent possible, in counsel during emergency condition;
- notifies and cooperates with Operator in conducting emergency procedures.

2. Position: Master

a) Overall Responsibility

- in complete command of vessel;
- responsible to charterer's representative
- maintains control over vessel and keeps Operations Manager advised of operation

b) General Safety Responsibilities

- ensures licenses and tickets of crew up to date;
- ensures all crew members are familiar with safety equipment and procedures;

- ensures equipment is in a state of readiness;
- directs safety, training and drills.

c) Emergency Responsibilities

- positions himself on his bridge;
- determines exact nature, location and requirements of emergency; probably from "on-scene commander";
- advises on-scene commander of own location and estimated time of arrival at emergency location;
- alerts other organizations, including own company, only if requested by on-scene commander;
- generally determines action to be taken and advises Chief Engineer of communication to be sent;
- depending on nature of emergency, would be in contact with senior toolpusher or rig captain (as on-scene commander);
- would not take directions from on-scene commander if contravenes safety procedures and seriously endangers safety of himself, crew and vessel.

3. Chief Engineer

a) and b) Overall and General Safety Responsibilities Purposely Omitted.

c) Emergency Responsibilities

- positions himself on bridge;
- determines the radios and frequencies being used;
- readies himself to receive and transmit by appropriate and available means, instructions from master;
- advises charterer's representative of emergency status of vessel.

4. Chief Officer

a) and b) Overall and General Safety Responsibilities Purposely Omitted

c) Emergency Responsibilities

- positions himself on main deck area with portable radio;

- directs crew designated to him to carry out appropriate rescue/assistance procedures;

- ensures appropriate rescue/survival equipment ready and, if appropriate, used by his crew;

- designates a look out for bridge duty;

- informs the bridge, through the Chief Engineer, of progress.

5. 2nd Officer

a) and b) Overall and General Safety Responsibilities Purposely Omitted

c) Emergency Responsibilities

- will carry out duties including readying and testing rescue boat, its engines, fuel, etc. to ensure it is in a ready state.

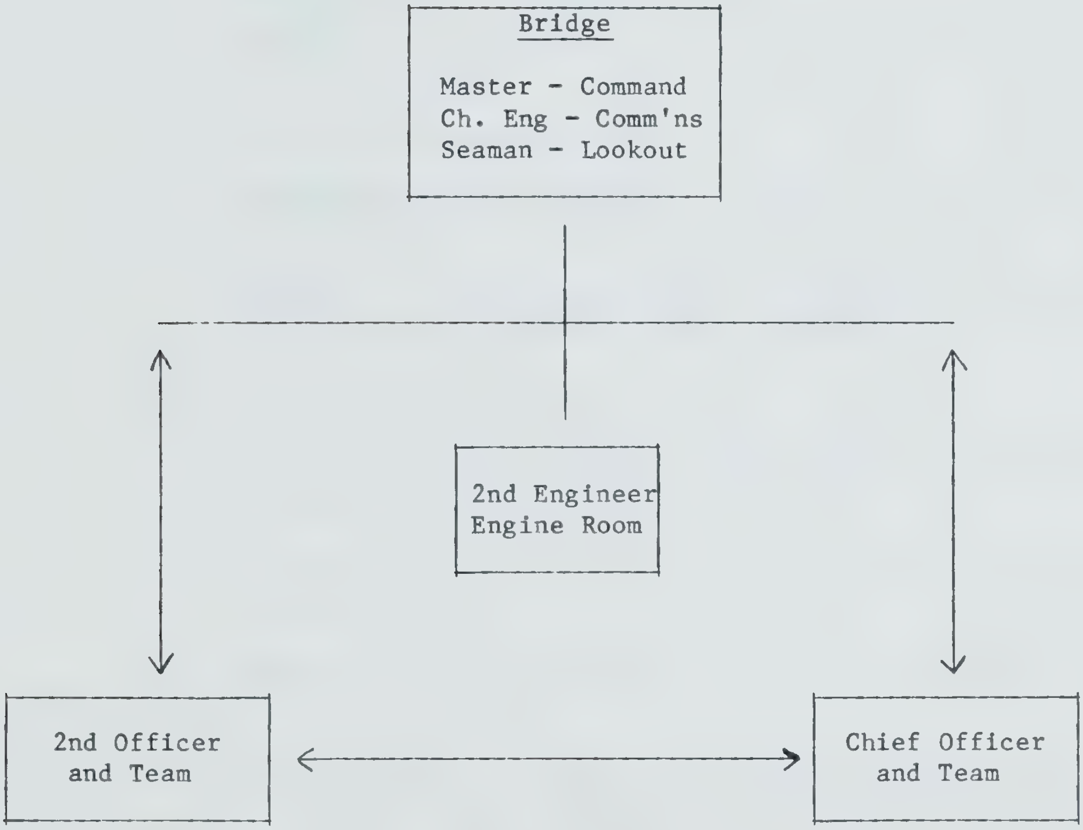
- ensures electrical equipment and ensures rescue search light are ready and operational.

- inform bridge of readiness;

- act on direction from Master.

SUPPLY BOAT/STANDBY VESSEL

EMERGENCY ORGANIZATION



LOCATION: MAN OVERBOARD BOAT

- ready lifeboat or mob boat
- secure electrics
- ready portable searchlight
- start and ensure functioning of engine

LOCATION: MAIN DECK AREA

- ready crane and onboard rescue equipment
- establish and dispatch lookout to bridge

⟷ communications

B. HELICOPTER COMPANIES

1. Position: Operations Manager

a) Overall Responsibility

- administers the company operation and contracts
- ensures normal and emergency operating procedures are in place and understood by all staff.
- ensures flight service operating requirements of the oil company are met.

b) General Safety Responsibility

- Update safety practices and procedures with Chief Pilot and other senior safety and operational managers;
- ensures, through chief pilot, new crews are indoctrinated in own and oil company's safety practices.

c) Emergency Responsibilities

- receives notice of emergency from Operator's shore based operations superintendent, drilling foreman, or other Operator's official.
- notifies standby helicopter crew to ready themselves in hangar;
- maintains contact with C.F.F., Operator's personnel and helicopter captain.

Note: companies may assign a "job manager" to directly supervise the helicopter operations for a specific oil company. The job manager may also be the first to be contacted by the oil company in an emergency. He would then, in addition to contacting the operations manager, carry out the emergency duties noted above.

2. Positon: Chief Pilot

a) Overall Responsibility

- ensures pilots meet all standards of the company, and are up to date in their training certification and proficiency checks.
- ensures pilots meet Operator's standards and operating needs.
- generally administers crews and hangar operations.

b) General Safety Responsibilities

- updates and administers safety manual procedures and drills.
- relates to operations control actions and other appropriate personnel for the planning and conduct of safety exercises.
- ensures pilots are proficient in safety and emergency procedures and that Operator's and own company standards are met.

c) Emergency Responsibilities

- advise crews and crew captains on emergency procedures, as required.
- involved in and may call alert for standby crew
- maintains record of emergency steps, in conjunction with operations manager.
- may be person assigned to maintain contact with C.F.F.

III. SUMMARY OF CANADIAN COAST GUARD, RCC/S&R RESPONSIBILITIES

The following represents a brief overview of the responsibilities and interrelationships of the C.C.G., Search and Rescue (S.& R.) and Rescue Command Centre (R.C.C.) in emergencies involving the east coast drilling systems. These notes are not intended to be definitive but rather to illustrate the general communication and response patterns in an emergency.

A. CANADIAN COAST GUARD (C.C.G.)

In some locations, C.C.G. is organized as a S&R sub-centre (for example, in St. John's) and administers their sector S&R marine activities under R.C.C. command in Halifax.

Close cooperation is also assured with the U.S. Coast Guard. Whichever organization receives a call for help first, will usually assume command.

- C.C.G. has radio "listening stations" dispersed throughout the region.
- Distress signals can be picked up by these stations and/or C.C.G. bases.
- Notify S&R/RCC of emergency.
- Task own or other marine (such as fisheries) vessels if appropriate.
- Assume "on-scene command" if appropriate.
- Monitor radio transmissions from rig.
- Maintain contact with R.C.C. and Central Flight Following (CFF)

B. R.C.C./S&R

Rescue Command Centre (part of the Department of National Defence - D.N.D.) is the central coordination and direction agency for Search and Rescue activities, located in Halifax. They are powered, not only to mobilize their own fixed wing and helicopter aircraft, and C.C.G. vessels, but also to task D.N.D. naval and air craft for search purposes.

Their marine activities are decentralized through subcentres which embrace C.C.G. facilities in St. John's Nfld., Summerside, P.E.I. and Halifax, N.S.

- Receive calls for help directly or through C.C.G.
- Assess emergency and define nature of assistance required.

- Direct all search and rescue activities.

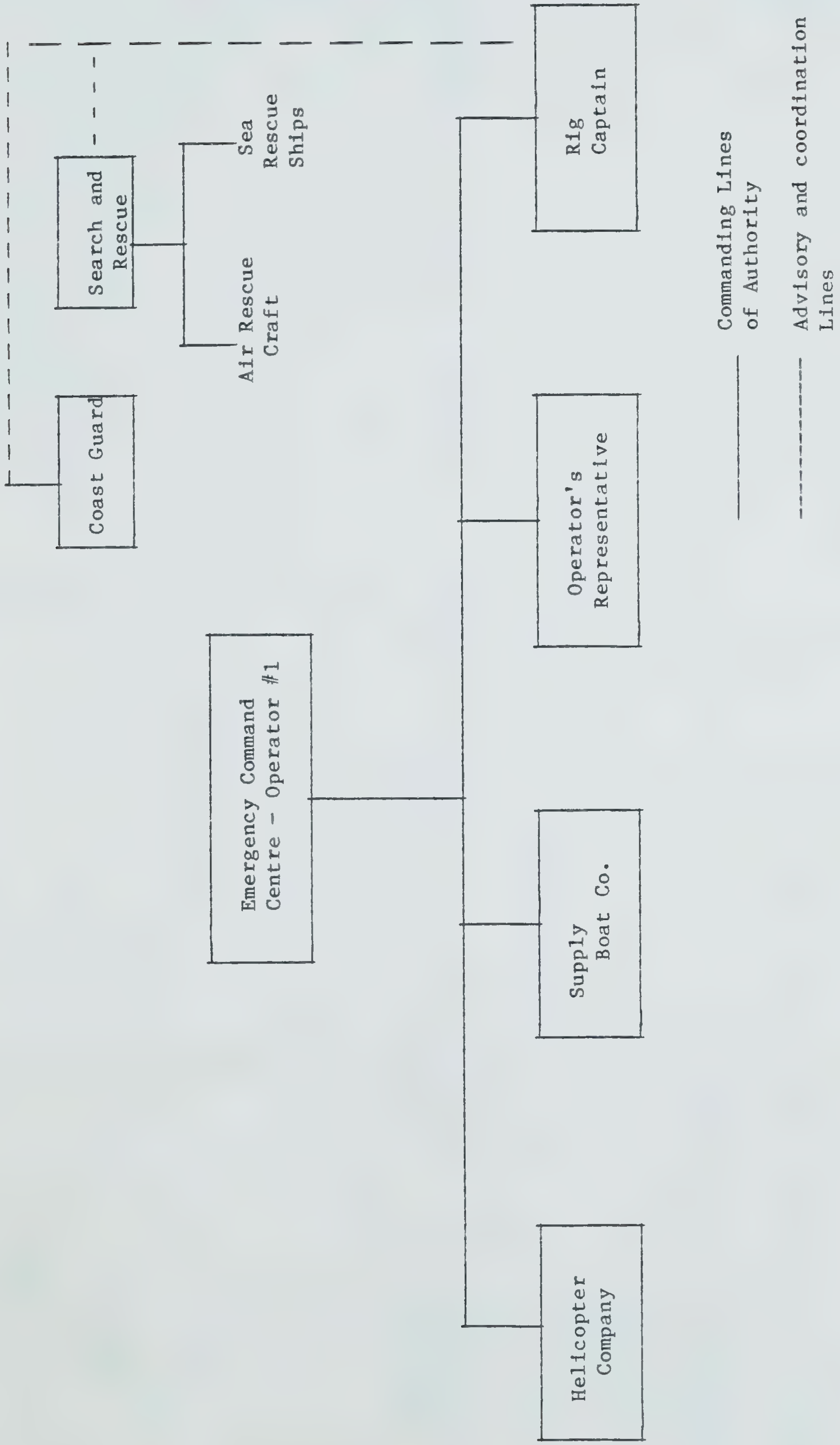
- Provide direction to sub-centre involved and to other services tasked to the search.

- Maintain contact with C.F.F. and the operator's emergency control staff and, if appropriate the multi operator response organization.

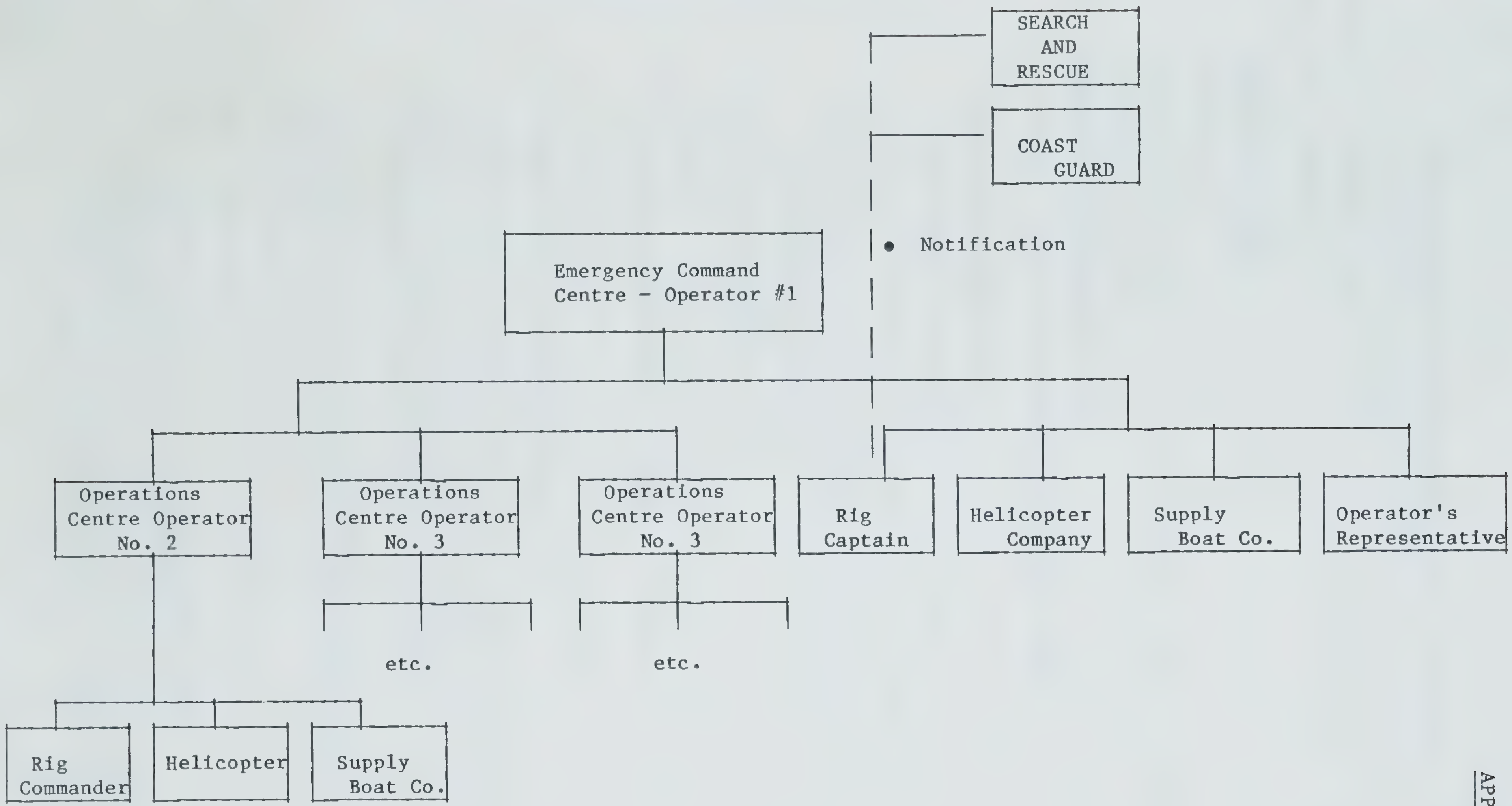
- Call for a cessation of search activities when appropriate.

COMPARISON OF REMOTE LOCATION VS
MULTI-OPERATOR COMMAND STRUCTURES

SINGLE-OPERATOR ORGANIZATIONAL MODEL



MULTI-OPERATOR ORGANIZATIONAL MODEL



*Operator #1 is the operator experiencing the emergency

MODEL COMMAND STRUCTURES FOR JACK-UP RIG OPERATIONS

MODEL: DRILLING COMMAND STRUCTURE

RIG TYPE: JACK-UP

I. ORGANIZATION CHART

(see Chart II)

Jackups operate under a clear unity of command with a rig superintendent (toolpusher) in charge.

II. DESCRIPTION OF RESPONSIBILITIES:

A. POSITION: RIG SUPERINTENDENT (SENIOR TOOLPUSHER)

1. Overall Responsibility

- Ensures that the operator's drilling plan is carried out.

- Oversees management of all operations on the rig.

- May supervise and/or be in charge of moving rig if he has a certification. Usually someone else ("rig mover") is responsible for the moving of the rig.

2. Safety Responsibilities

- Ensures all safety procedures and systems in place and followed.

- Overall responsibility for safety of men and rig.

- Ensures safety drills carried on and evaluated.

3. Emergency Safety Responsibilities

For purposes of this discussion, the rig superintendent on board has ultimate authority and responsibility for the safety of the staff, rig, and well while the rig is in-situ on the hole. Command will only change when the rig is readying to move, is moving, or is in port. At those times it is signed over to the "rig mover".

In emergency situations, including fire on board, loss of helicopter (crash) and loss of rig and ability, the toolpusher orders the well to be shut in or the drilling crew to hang off in advance of evacuating the rig where time permits.

a) Fire on Board

- Positions himself in the control/radio room
- Directs the appropriate firefighting team
- Receives damage control report and assesses situation
- Determines if the situation is such that a partial or potential complete evacuation may be required and alerts crew to ready themselves for potential evacutation

- If fire is severe enough commands supply boat through the operator's representative to prepare for evacuation of personnel. If helicopter support is required will again through the operator's representative request for helicopter support

- May initiate, through his shore-based command, the institution of the multi-operator alert response plan.

b) Loss of Well Control

- Assesses situation from the drilling floor.

- Directs crews to prepare to shut in the well. If the situation is a severe kick, may alert crew for partial evacuation involving non-essential personnel.

- Assess the situation with company representative and inform own shore based manager of the status.

- If control of the well has been lost, alerts the Canadian Coast Guard/RCC and through the operator's representative requests additional support craft including supply boats, stand-by vessels and helicopters for evacuation of crew.

- If condition is severe and additional help is required, may request, through his base manager, the institution of the multi-operator response plan.

- Ensures that all crew are accounted for and are assembled in their lifeboats and that all equipment, where possible, has been secured.

c) Loss of Helicopter

- If helicopter is overdue, through radio operator and operator's representative, contacts the Coast Guard, shore-based manager and the helicopter company to establish and maintain contact.

- Provides direction to last known point of contact.

- Through the operator's representative, dispatches standby vessel to engage in search.

- If helicopter has crashed on board institutes the fire fighting activities.

- Notifies his operations base of any injury or death as a result of the crash and requests medical assistance or a medivac.

d) Loss of Main Support Craft

- If the loss is other than the stand-by vessel establishes communications with the stand-by vessel through the operator's representative.

- Monitors communications between the stand-by vessel and search helicopters which have been tasked by the operator to engage in search activities.

- Notifies the operations base and the Canadian Coast Guard.

- Stands by to offer any appropriate aid if called upon by the stand-by vessel captain or the search and rescue onscene commander.

e) Loss of Rig Stability

- If stability is threatened as a result of a collision with another vessel, dispatches damage control team, assesses report and determines if evacuation is necessary.

- If stability is threatened by other situations such as approaching heavy weather or the approach of an out-of-control vessel, establishes contact with base to inform them of the situation and to track the approaching condition.

- Confers with operator's representatives to assess the situation and to alert stand-by vessels, helicopters, other operators, and possibly Coast Guard/Search and Rescue to a potential rig evacuation situation.

- If evacuation is ordered, arranges for the sounding of the appropriate alarms, directs crews to ready for evacuation, informs base of decision, and requests other assistance that may be required such as CCG/S& .

- If situation is severe, may request institution of the multi-operator response plan.

- Directs drilling crew to shut in and/or hang off the well.

B. POSITION: BARGE MASTER (BARGE ENGINEER)

Usually has a marine ticket.

1. General Responsibilities

- Manages preventive maintenance and materials control functions.

- Organizes and directs drilling support operations.

- Assists in training crew.

- May have a rig movers ticket, since he knows buoyancy and stability.

2. General Safety Responsibilities

- Training in use of equipment, procedures.
- Assures that all appropriate equipment on board and in operating condition.
- Monitors, with superintendent, safety drills.

3. Emergency Responsibilities

a) Fire on Board

- Assists senior toolpusher/superintendent in assessing situation.
- At the superintendent's direction, sounds appropriate alarms.
- Ensures power and mechanical systems are protected or shut down as required.
- May direct a firefighting team.
- Directs own survival boat crew in the event of evacuation.

b) Loss of Well Control

- Commands control room during well control procedures.
- Ensures hatches and doors are closed.
- Coordinates with superintendent on well shut in procedures.
- If control is lost, assists in directing evacuation procedures.
- Commands own assigned survival boat crew during and subsequent to evacuation.

c) Loss of Helicopter

- Directs control room operations.
- Directs damage control team if there is a crash on board and ensures power and systems are protected or shut down as required.
- Commands radio transmissions as directed by superintendent and/or operator's representative.

- Assists in coordinating full or partial evacuation, if necessary.

d) Loss of Main Support Craft

- Assists superintendent as directed.
- Commands radio transmissions as requested by superintendent and/or operator's representative.
- Commands the operation of the fast rescue boat if required.

e) Loss of Rig Stability

- Assumes command of the control room if a collision has been incurred: instructs the damage control team in correct procedures.
- Assesses problem and begins corrective action procedures in the control room.
- Advises watchstander of course of action.
- Coordinates with the rig's superintendent in the event of a decision to hang off.
- Commands radio transmissions as directed by the operator's representative or the rig superintendent.
- Institutes, at the direction of the superintendent, evacuation procedures if required.

III. RIG MOVING

- A certified rig mover is in charge of operations.
- There is a formal sign-on/sign-off procedure for transfer of control to and from rig superintendent.
- Rig mover ensures rig stability and buoyancy.
- Confers with tow master on tug who is master of towing operation.
- Maintains communication with tow master.
- In cases of "tug move", the master of the barge hauling the rig is in overall command.

IV. VARIATIONS

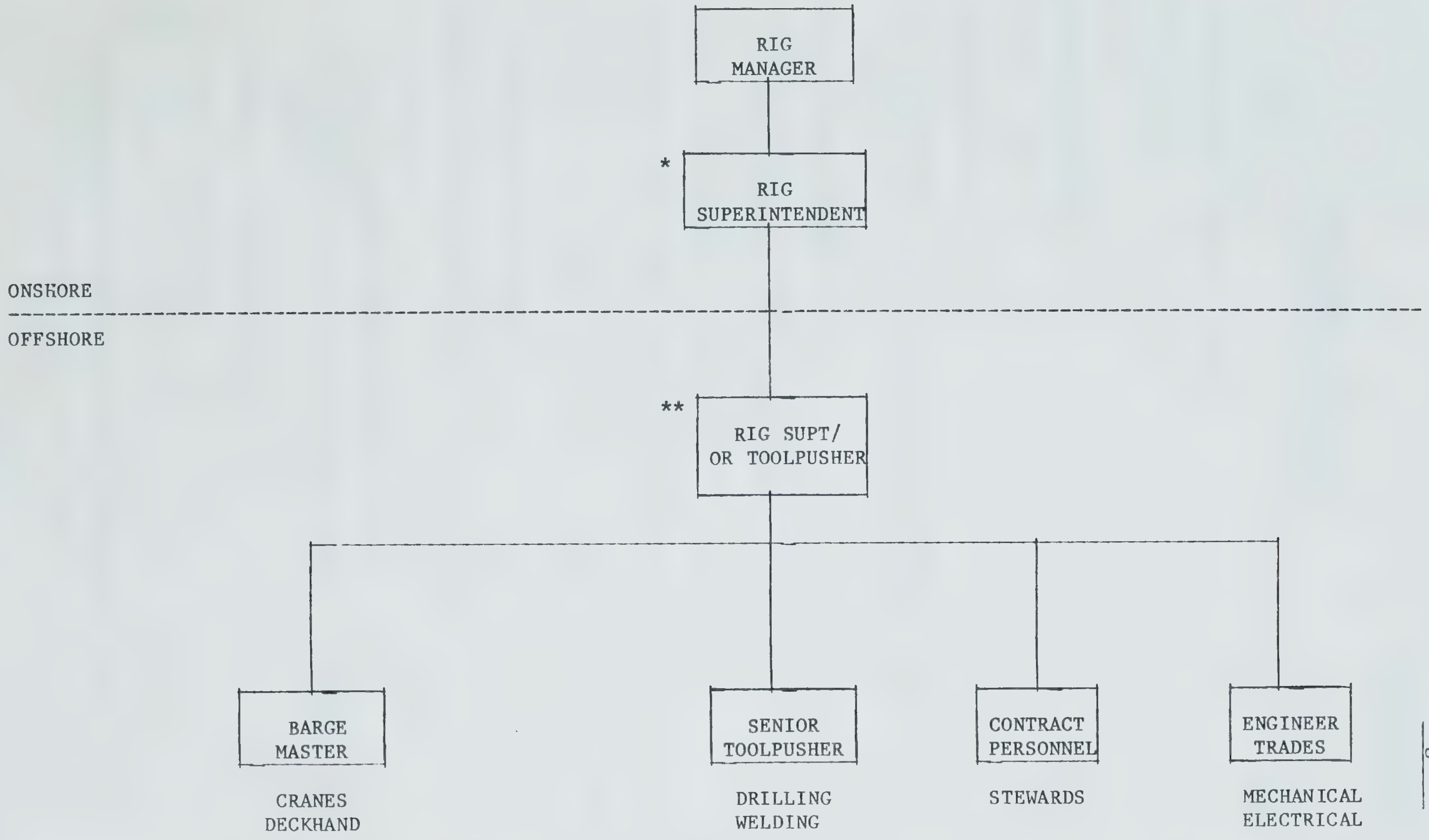
Generally, there appear to be few if any substantial variations among the command structures for jack-up rigs.

Some have their own motor capability but all must be towed or carried by a barge to move. Therefore the marine orientation on the rigs is very much secondary to the drilling, except while under tow.

The Barge Engineer (or Barge Master) on a rig may be a drilling or marine oriented person. But his assistant will complement the senior person's skills. Usually the Barge Master is marine oriented, his assistant drilling oriented.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: JACKUP



* IN SOME CASES THIS POSITION IS STATIONED ON THE RIG. ** USUALLY POSSESSES MARINE & U.S. COLUMNIZED TICKET

MODEL COMMAND STRUCTURES FOR DRILL SHIP OPERATIONS

RIG TYPE: DRILL SHIP

MODEL: TYPICAL SHARED COMMAND STRUCTURE

I. ORGANIZATION CHART

(see Chart)

II. DESCRIPTION OF RESPONSIBILITIES:

A. POSITION: CAPTAIN

1. Overall Responsibility

- Has responsibility for all aspects of the vessel's operations and all personnel on board. Responsibilities include navigation, operation, safety, and legal and medical matters.

2. General Safety Responsibilities

- Safety conditions of vessel, e.g. life boats, equipment, etc. all people through in part, rig manager.
- Calling and assessing safety drills with rig manager.
- Maintains contact with rig manager and assists in providing support to drill operations and ensuring safety.
- Monitors drilling operations particularly where ballasting becomes critical.
- Oversees bridge operations.

3. Emergency Safety Responsibilities

a) Fire on Board

- Overall supervisor of firefighting boats
- Assess situation from input from crew and fire fighting team captains
- Orders all hands to stations
- Notifies rig manager
- Notifies Coast Guard
- Determines if severity of fire warrants abandon ship
- Calls for "abandon ship" or "all clear"

b) Loss of Well Control

- Instructs radio operator to announce gas alert (if well control not yet lost) [Note: This order could be given by rig manager]
- Receives alert from rig manager to sound general alarm
- Directs abandon ship procedures if required (see abandon ship duties)

c) Loss of Helicopter

- Receives notice from observer on radio operator
- If helicopter on the deck, captain sounds fire alarm, or if in water nearby, the man overboard alarm
- Directs response to accidents, or fires on deck
- Coordinates rescue at sea
- Initiates and supervises fire or man overboard procedures

d) Loss of Main Support Craft

- Receives notice from observer or radio operator
- Notifies Coast Guard and Search and Rescue
- Initiates and directs rescue at sea operation if applicable
- Notifies Rig Manager

e) Loss of Rig Stability

If the safety and stability of the rig is threatened or has occurred the captain may decide to evacuate the vessel.

- Orders evacuation alarm on the ship's whistle, horn and intercom.
- Informs drilling Superintendent (senior drilling manager on board) and shore based superintendent or manager.
- Informs government agencies
- Directs evacuation procedures
- Issues Mayday call if necessary, notifies C.C.G./S&R

B. POSITION: RIG SUPERINTENDENT

1. Overall Responsibility

o Represents both the owner and Operator in his responsibility for the total operation of drilling activities.

- Repsonsible for work effectiveness and training of drilling crew.

2. General Safety Responsibilities

- Ensures drilling crew trained in and knowledgeable of safety procedures and equipment.
- Makes decisions re: safety matters related to well drilling operations and well control.
- Participates in leading weekly safety meetings.
- Reviews safety performance with Captain and shore-based management and safety personnel.

3. Emergency Responsibilities

a) Fire on Board

- coordinates with the Captain in assessing the apparent danger as a result of the fire.
- Directs firefighting crew if appropriate.
- Prepares drilling crew to shut in and disconnect if this is necessary.
- Confers with Captain if rig needs to be evacuated.
- Ensures that the well is shut in and disconnection procedures are underway in the event of a necessary evacuation.

b) Loss of Well Control

- Advises Captain if the rig has experienced a major kick.
- Directs crew to control and shut in well if necessary.
- Ensures, with the Captain, that nonessential personnel are removed from the immediate area and are prepared to evacuate.
- Informs Captain if well control is lost.
- Proceeds to assist in evacuation procedures.

c) Loss of Helicopter

- If chopper crashes on deck, assists in assessing damage.
- Assists or directs firefighting manouvres as required.

- Commands crane operation for removal of helicopter if necessary.

- Assesses effect of on the drilling operations and directs crew to shut in well and disconnect if necessary.

d) Loss of Main Support Craft

- If collision with another vessel has occurred, assists Captain in assessing damage.

- Determines need to shut in or disconnect; directs this procedure if required.

e) Loss of Rig Stability

- If collision with another vessel, see (d) above.

- If approaching bad weather or ice, coordinates with Captain in monitoring progress of impending danger. Alerts crew to prepare to shut in and hang off the well.

- If safety limits are exceeded, directs hang-off procedure.

- If danger is immediate and stability is failing, assist in directing evacuation procedures as called by the Captain.

III. TYPICAL VARIATIONS FROM THE NORMAL COMMAND STRUCTURE

Although many of the drill ships tend to operate under the marine command, there are other variations. To a certain extent these are dictated by whether the drill ship is a dynamically positioned ship or an anchored ship. If it is dynamically positioned, usually the marine structure with the Captain as supreme commander in all situations will be in force. If it is an anchored vessel then the other variation where a joint command of the vessel by a Captain and the senior drilling person may be the case.

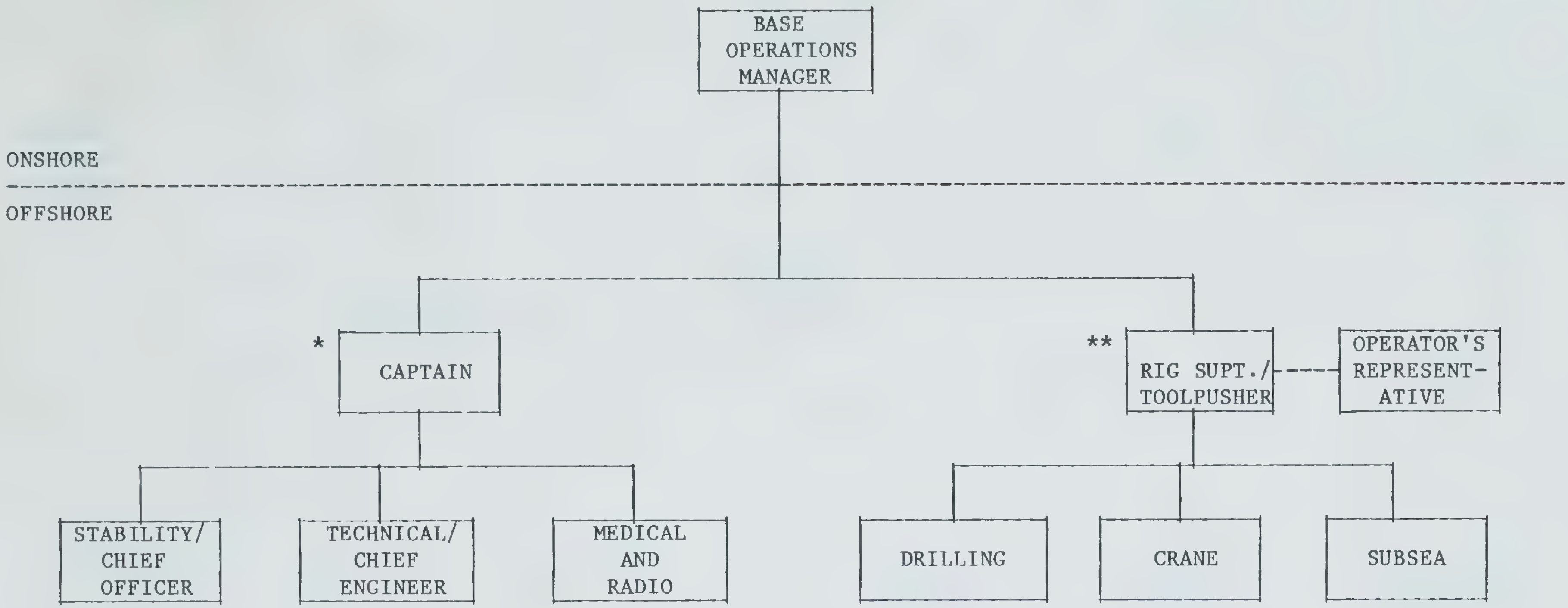
Where the marine structure is not being followed, normal operational duties are shared between the Captain and the senior Toolpusher or drilling person. The Captain nevertheless will take overall command of the vessel in the event of an emergency situation and certainly when the vessel is underway.

As with the semi-submersibles, the results of our discussion indicate that in some cases, regardless of the organizational relationships on a chart, the crew on board the vessel will sometimes view the senior drilling person as the real boss of the operation. However, no hard evidence of these statements has been observed by the study team.

The qualifications for the Captain on board a drill ship are that he must have an unlimited master's ticket as well as having had extensive experience in the off-shore drilling operations. Once again, there is a shortage of marine Captains to command drill ships who have had extensive experience in offshore drilling, particularly in Canada.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: DRILL SHIP -
ANCHORED - SHARED COMMAND

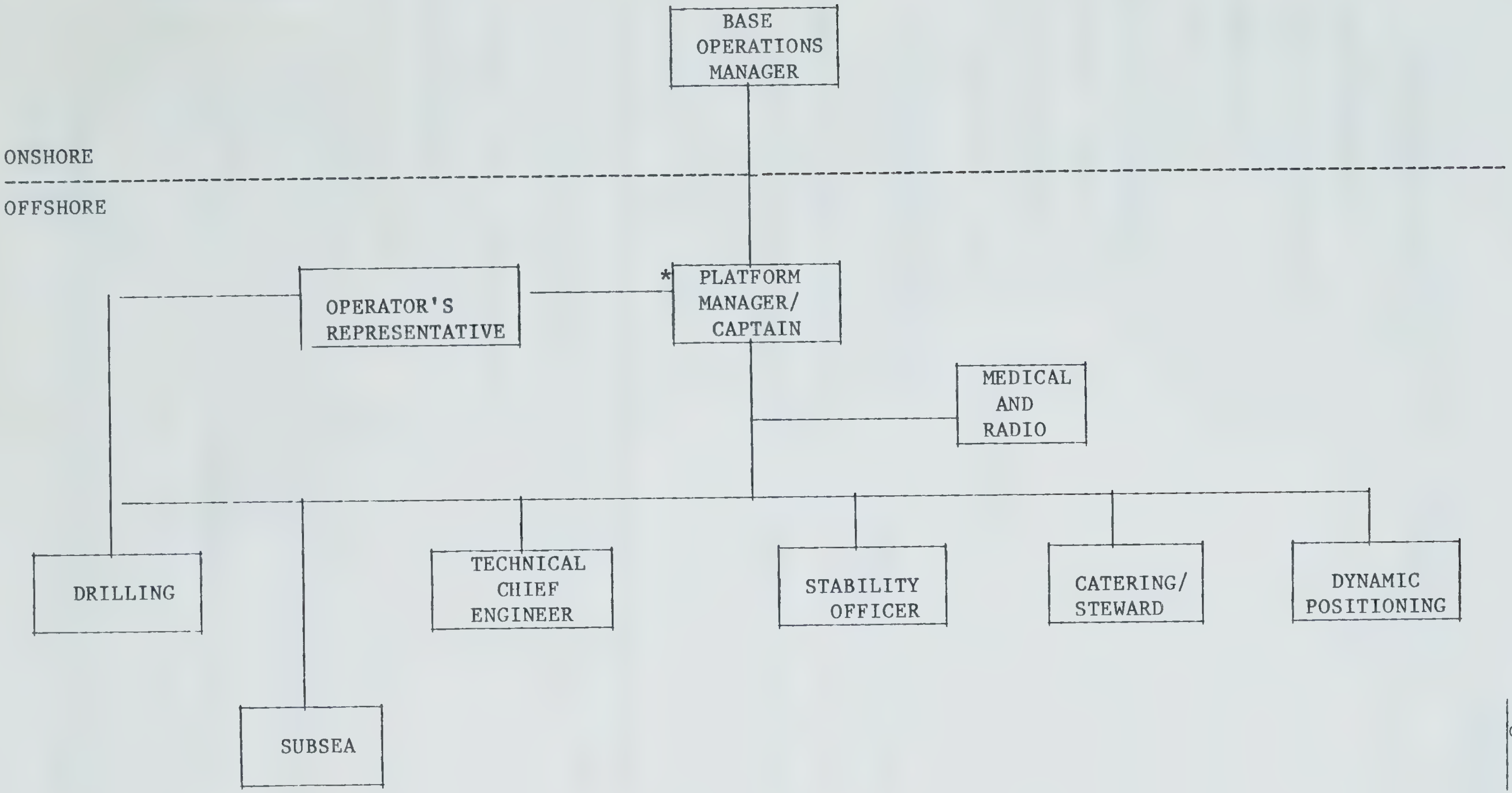


*CAPTAIN RESPONSIBLE FOR THE SHIP WHILE MOVING AND IN THE EVENT OF AN EMERGENCY WHICH MAY ENDANGER THE PERSONNEL AND SHIP.

** THE RIG SUPT. AND CAPTAIN SHARE EQUAL RESPONSIBILITY WHILE DRILLING.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: DRILL SHIP -
DYNAMICALLY POSITIONED
MARINE COMMAND



* THE CAPTAIN (OR PLATFORM MANAGER) IS IN COMPLETE AUTHORITY IN ALL SITUATIONS; WHILE THE SHIP IS UNDERWAY, STATIONARY AND DRILLING, AND IN EMERGENCY SITUATIONS.

MODEL COMMAND STRUCTURES FOR SEMI-SUBMERSIBLE RIGS

RIG TYPE: SEMI-SUBMERSIBLE

MODEL: MARINE COMMAND STRUCTURE

I. ORGANIZATION CHART

(see Charts)

II. DESCRIPTION OF RESPONSIBILITIES:

A. POSITION: CAPTAIN

1. Overall Responsibility

- Manages marine related operation including:
  - moving and positioning rig
  - ballast control and stability
  - engineer, tradesmen, radio, crane, medical and roustabouts.

2. General Safety Responsibilities

- If safety of personnel or rig are threatened the captain assumes overall authority and command.
- Safety condition of rig, e.g., boats, equipment, etc. all people through, in part, toolpusher;
- Calling and assessing, with Senior Toolpusher, safety drills;
- Establishing drill procedures in cooperation with senior toolpusher and shore based operations and safety people;
- Oversees flight deck operations.

3. Emergency Responsibilities

a) Fire on Board

- Overall supervisor of firefighting teams
- Assesses situation from input from fire captains
- Determines if severity of fire warrants abandon ship if this is safer than remaining on board
- Calls for "abandon ship" or "all clear"
- Directs communication to external support services, e.g., R.C..C & C.C.G.

b) Loss of Well Control

- Instructs radio operator to announce gas alert (if well control not yet lost) [Note: This order could be given by Senior Toolpusher]

- Receives alert from Senior Toolpusher to sound general alarm
- Directs abandon ship procedures

c) Loss of Helicopter

- Receives notice and available details from Radio Operator
- If helicopter on deck, Captain sounds fire alarms, or if in water nearby, then the man overboard alarm
- Assesses severity of accidents and fires on deck and reports deaths or injuries to Operator's representative.
- Coordinates rescue at sea

d) Loss of Main Support Craft

- Establishes communications with standby vessel through operator's representative.
- Monitors communications between standby vessel, search helicopter(s) tasked by the operator and other non search and rescue craft involved in search.
- Stands by to offer appropriate aid if called upon by standby vessel captain or R.C.C./S&R commander.

e) Loss of Rig Stability

If damage is sustained, or ballasting equipment is broken down:

- Mobilizes damage control team and assesses damage/problem.
- Reports situation to drilling foreman and senior toolpusher.
- Requests assistance from standby vessel (if not involved in incident or is still operationally safe), and other company owned or other operator's vessels.
- Confers with Senior Toolpusher if it is determined there is a need or a potential need to hang off.
- Puts personnel on alert if condition potentially serious.
- Maintains contact with other rigs/vessels/aircraft/S&R as appropriate.
- Orders partial or complete evacuation if condition warrants.
- Asks drilling foreman to initiate multi-operator response plan through his base command, if necessary.

If heavy weather is approaching:

- Maintains watch in the pilot house;
- Ensures one of chief engineer, 1st mate, or engineer on each shift is in control room to assist in emergency situations;
- Monitors forecasts, sea conditions, vessel behaviour, in heavy weather and well condition with senior toolpusher;
- Decides with Senior Toolpusher to prepare to hang off if weather deteriorates and/or operating limits are exceeded;
- Informs toolpusher of sudden changes in conditions which could affect personnel safety;
- Carries out appropriate measures if informed by senior toolpusher that emergency well conditions have developed;
- Informs operators representative if drilling should cease, following discussion with senior toolpusher;
- Assists senior toolpusher, as appropriate during disconnect proceedings;
- Confirms with senior toolpusher that changes in conditions permit reconnection;
- Ensures all crew personnel and equipment are acting in the survival mode when vessel is disconnected;
- Decides to evacuate, and the method, if conditions warrant;
- Takes charge of reboarding and is on first flight to the rig.

B. POSITION: SENIOR TOOLPUSHER (Rig Supt.)

1. Overall Responsibility

   - Manages all drilling operations through shift toolpushers (one off rig at any one time);
   - Responds to and carries out program in liaison with Operator's representative.
   - Responsible for work effectiveness and training of drilling crew.

2. General Safety Responsibilities

   - Ensures drilling crew trained in and knowledgeable of safety procedures, emergency procedures and equipment;

- Participates in leading weekly safety drills and meetings;

- Reviews safety performance with Captain, and shore-based management and safety personnel.

3. Emergency Responsibilities

a) Fire on Board

- Directs the activities of a firefighting team from the Pilot house;

- Communicates with duty toolpusher on drilling floor

- Assists in directing partial or full evacuation of rig if called upon by the Captain.

b) Loss of Well Control

When loss is threatening:

- Receives notice from Toolpusher;

- Directs drill crew to secure well;

- Gives orders to offduty Toolpusher and crew as required;

- Requests Captain, or radio operator directly, to announce gas alert;

- Informs Captain if control has been lost;

- Carries out own evacuation responsibilities.

c) Loss of Support Craft (Helicopter)

- Responds to directions from Captain if a fire on board or man overboard situation.

- Ensures drilling floor system secure and alerts crew to prepare to shut in well or hang off if situation warrants.

d) Loss of Main Support Craft

- Not generally directly involved in this emergency situation unless this person is in overall command of the rig at all times.

e) Loss of Rig Stability

If damage sustained or ballasting equipment is broken down

- Receives report from Captain and alerts drilling crew to potential hang off position.

- If hang off or evacuation is required, secures well and hangs off.

- Ensures his evacuation/boat teams are mobilized.

If heavy weather is approaching:

- Responsible for all drilling operations and to be informed of pending heavy weather or other dangerous marine conditions;

- Constantly monitors weather conditions and forecasts in cooperation with Captain;

- Keeps drilling if forecasts show improving weather;

- Orders cease drilling if prescribed operating limits are reached;

- Orders preparation to hang-off in event weather conditions deteriorate after cooperative assessment with Captain;

- Informs Captain if an emergency well condition develops;

- Informs Operator's representative during monitoring and decision making process;

- Orders disconnect if required (after consultation with operator's representative and Captain);

- Arranges the securing of subsea and on vessell drilling equipment and keeps Captain advised of activity in event rig is disconnected;

- Provides Captain support and directs his crew in event of evacuation;

- Accompanies Captain on first flight when reboarding is ordered.

III. TYPICAL VARIATIONS TO COMMAND STRUCTURES

There are two other common variations to the command structures on semi-submersible rigs from that described above. Essentially, they are, what we have named the "American" model , and the "Norweigan" model. To an extent these structures are dictated, in part, by the flag of registration of the vessel, the operating approach of owner, and whether the vessel is dynamically positioned or not. These Variations are described below:

A. "AMERICAN MODEL"

American owned and registered semisubmersible anchored rigs have historically been managed on board by a rig superintendent, or senior toolpusher. (Titles tend to vary from company to company). The

senior toolpusher will often have a columnized ticket which is available only in the U.S. and to U.S. citizens. In addition, a master marine ticket is required by the individual prior to him receiving his columnized ticket. These tickets provide for qualifications which are formally tested, in marine and floating rig operating technology. The senior toolpusher has complete authority and command over the vessel at all times.

In some cases, a master mariner may be stationed on board. His responsibilities are usually limited to commanding the radio and medical operations and being responsible for the Barge Master, which includes some maintenance and trades operations and possibly hull stability. If a Captain is on board, he responds at all times to the direction of the senior toolpusher. Seldom do captains in this case have extensive rig experience. They are often put in place to meet the guidelines or persuasiveness of the host country or operator.

The second in command of the vessel usually is part of the drilling organization. In an extreme event, command could shift to the Captain if one is on board, or to the Barge Master.

If a rig is a dynamically positioned type, then a master marine Captain is on board and has a more responsible role to play. Indeed, they tend to be more experienced in rig operations and, if sufficiently experienced, may be seen to be capable of acting as second in command to the senior toolpusher. Furthermore, most host countries, including Canada, deem a D.P. rig to be a vessel and require a master mariner on board when operating in their waters.

One of the reasons a mariner captain is not given broader responsibilities when on board, is apparently, the lack of sufficiently rig-trained and experienced mariners manners throughout the world.

In the "American" model, command on the rig is unified and clear under all situations. The extent to which the structure is effective in the Canadian North Atlantic is discussed in the body of this report.

B. "NORWEGIAN MODEL"

The "Norwegian" model represents a typical marine command structure to the extent that a master mariner, with an unlimited ticket is in command of the vessel at <u>all</u> times, whether it is a D.P. or anchored type. This is based on strict and extensive regulations set down by the Norwegian Government.

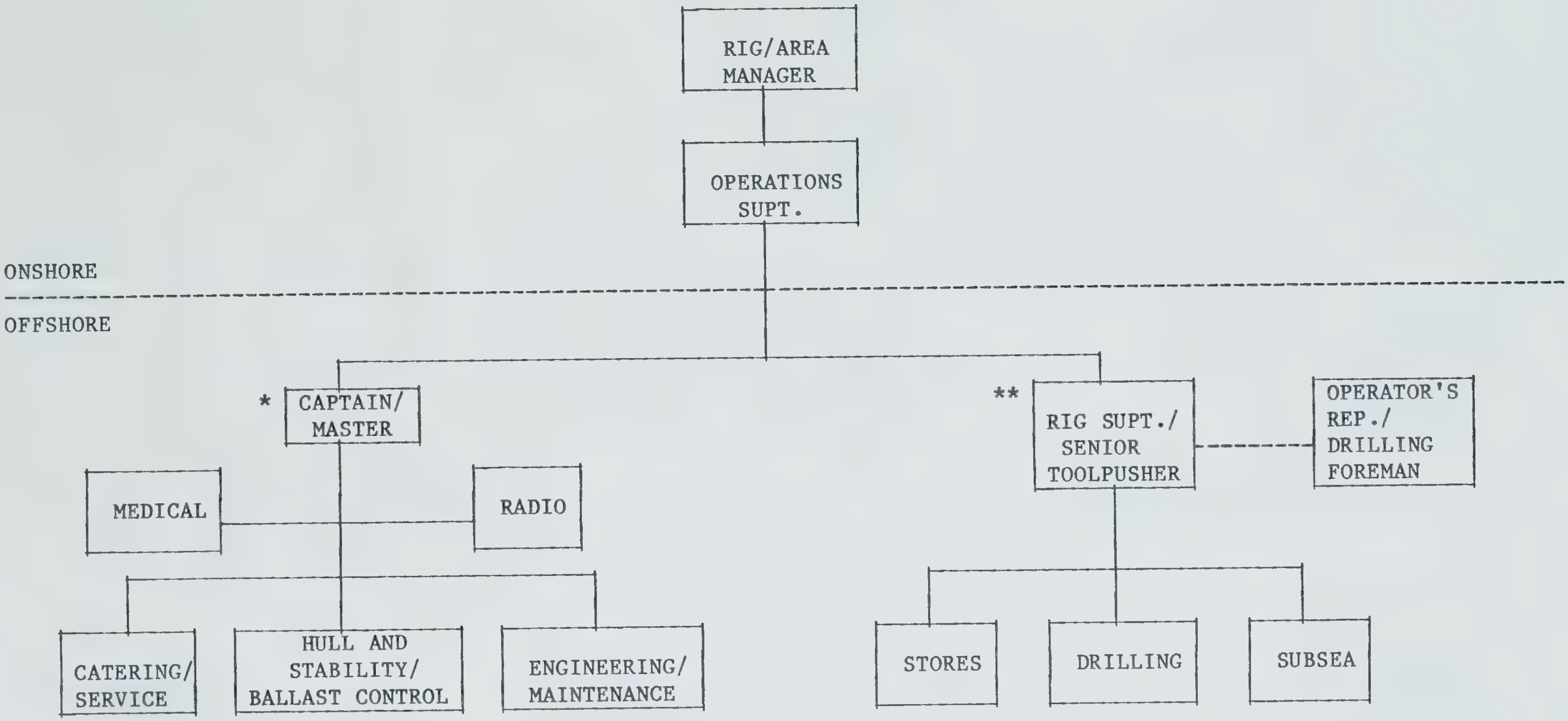
The senior toolpusher and all other major functions report directly to the Captain.

Clearly, the senior drilling person is in charge of the drilling operation, and confers with the Captain on a day-to-day and emergency basis. The Captain however, would call for an evacuation if he deems the situation to warrant it.

Through discussions with several senior operations people in the offshore drilling industry, some believe that, in the eyes of the crew on board, the real "boss" is still the senior drilling person. This feeling may be even stronger on an anchored rig, since the captain in this case does not play as full and obvious a role as on a D.P. rig. Notwithstanding these comments, the command structure as prescribed and indicated in position descriptions and organization charts is clear and unified.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE -
"NORWEGIAN" MODEL;
"CANADIAN" VARIATION



* CAPTAIN HAS ULTIMATE AUTHORITY WHILE THE RIG IS MOVING, IN EMERGENCIES, AND GENERALLY FOR THE SAFETY OF THE PERSONNEL AND THE RIG. UNDER NORMAL DRILLING OPERATIONS, THEY REPORT ON A FUNCTIONAL BASIS TO THE SENIOR TOOLPUSHER.

** THE RIG SUPT/SR. TOOLPUSHER IS NOT REQUIRED TO HAVE A RECOGNIZED MARINE RELATED CERTIFICATE, BUT IS TYPICALLY EXPERIENCED IN OFF-SHORE RIG OPERATIONS.

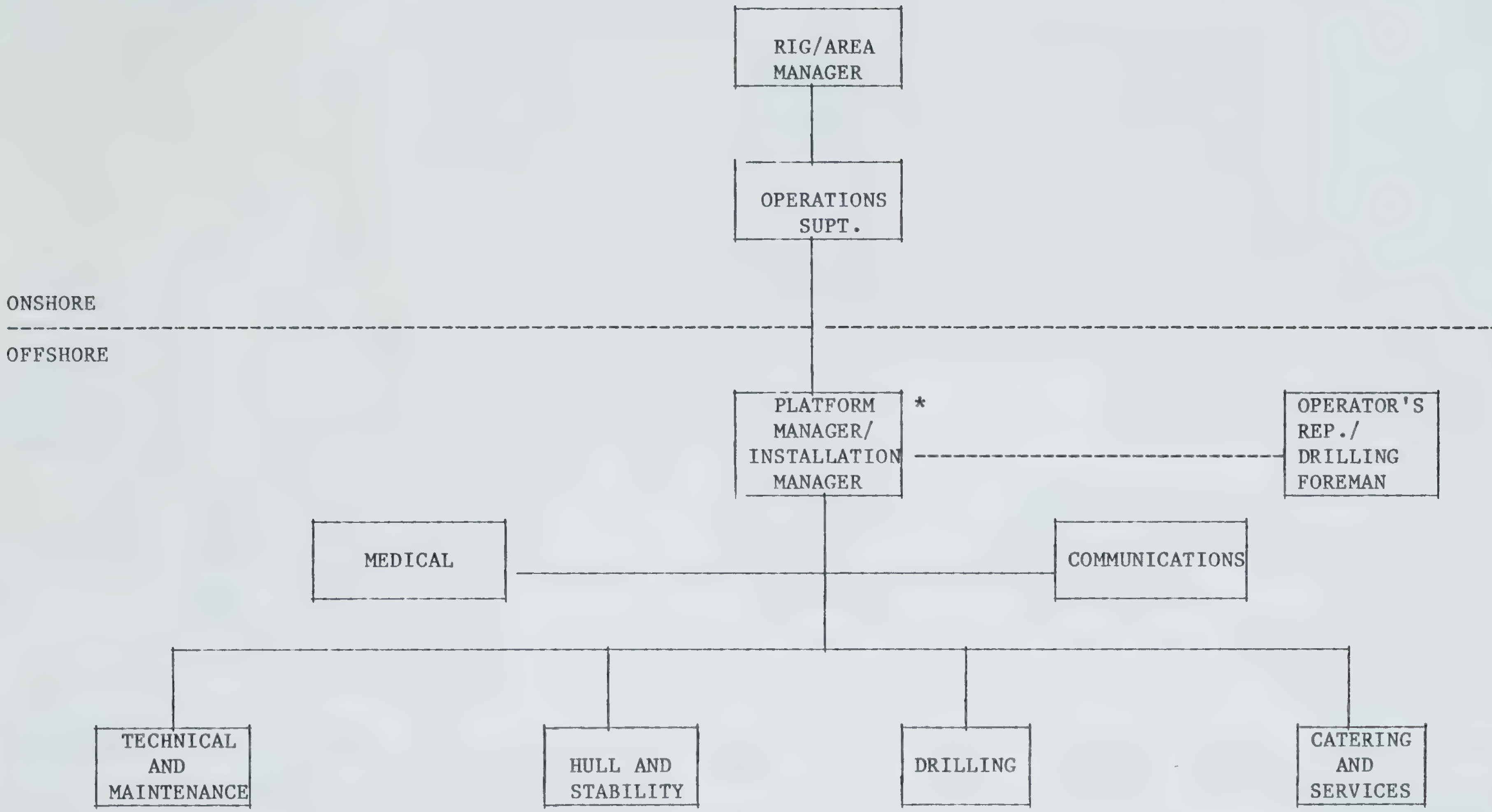
LEGEND:

______________ = COMMAND LINES

-------------- = FUNCTIONAL OR TECHNICAL LINES

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE
"NORWEGIAN" MODEL



LEGEND:

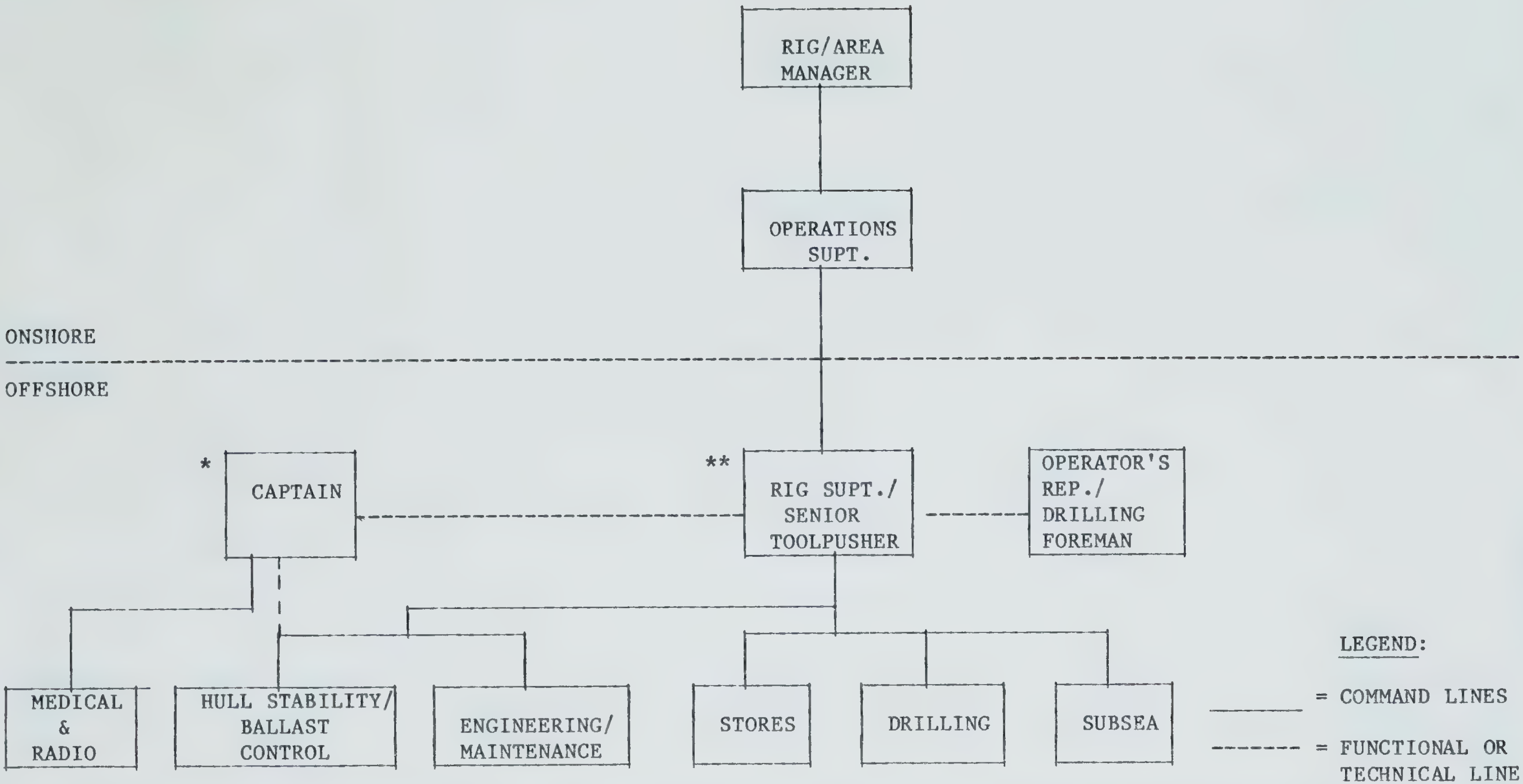
__________ = COMMAND LINES

---------- = FUNCTIONAL OR TECHNICAL LINES

* UNLIMITED MASTER'S TICKET. THIS PERSON IS RESPONSIBLE AT ALL TIMES FOR THE NORMAL OPERATIONS, AND THE SAFETY OF THE PERSONNEL & THE RIG UNDER NORMAL AND EMERGENCY CONDITIONS.

DESCRIPTION OF DIFFERENT COMMAND STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE
"AMERICAN" MODEL - 1

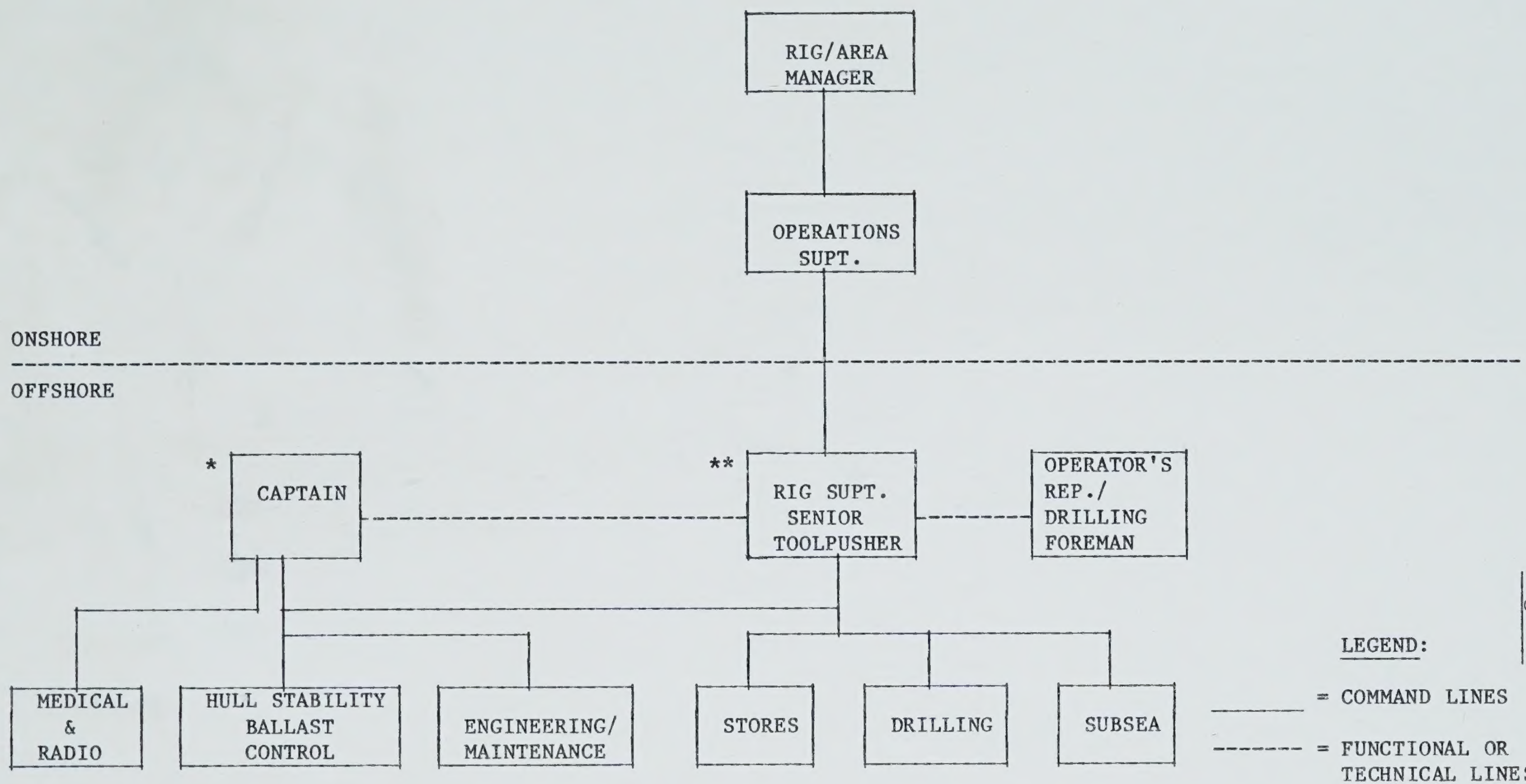


* THE CAPTAIN COMMANDS THE RADIO AND MEDICAL OPERATIONS, AND PROVIDES FUNCTIONAL ADVICE TO THE HULL STABILITY, ENGINEERING AND DRILLING OPERATIONS.

** THE SUPERINTENDENT OR SENIOR TOOLPUSHER HAS A U.S. COLUMNIZED AND MARINE TICKET. IN AN EMERGENCY AND DURING NORMAL OPERATIONS, HE ASSUMES OVERALL RESPONSIBILITY FOR THE OPERATIONS AND THE SAFETY OF THE PERSONNEL AND THE RIG.

DESCRIPTION OF DIFFERENT COMMAND
STRUCTURE MODELS

RIG TYPE: SEMI-SUBMERSIBLE
"AMERICAN" MODEL - 2



* THE CAPTAIN IS LEGALLY IN COMMAND OF THE VESSEL. HE MAY DECLARE A STATE OF EMERGENCY IF HE BELIEVES THE SAFETY OF THE PERSONNEL & RIG ARE JEOPARDIZED. UNDER NORMAL CONDITIONS, HE IS FUNCTIONALLY RESPONSIBLE TO THE SUPT./SR. TOOLPUSHER.

** THE SUPT./SENIOR TOOLPUSHER HOLDS A U.S. COLUMNIZED AND MARINE TICKET. HE MAY DIRECTLY COMMAND THE HULL STABILITY AND ENGINEERING GROUPS.